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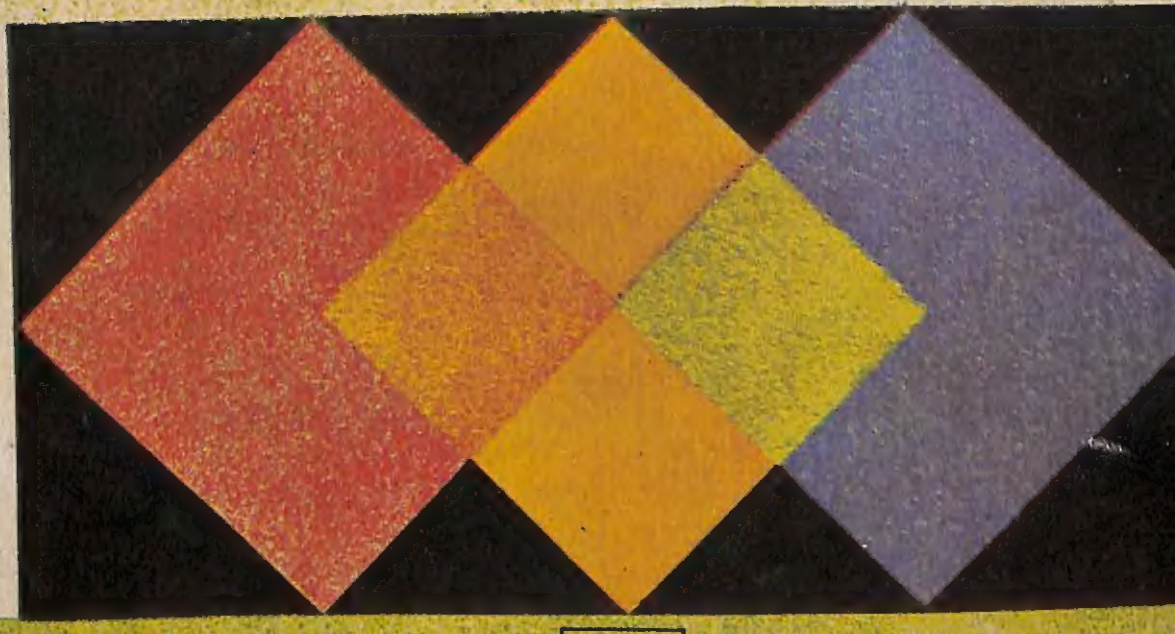
PROBLEM BOOK OF MATHEMATICS

CLASS VII



राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

PROBLEM BOOK OF MATHEMATICS

Class VII

ASHA RANI SINGAL MAHENDRA SHANKER
SUNDER LAL J.D. GUPTA

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
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Foreword

THE Department of Education in Science and Mathematics (DESM) of the NCERT has been engaged for several years in developing packages of curriculum materials in mathematics for various stages of schooling. It has published a new series of textbooks in mathematics for different classes as a part of instructional packages development programme under the new National Policy on Education (NPE). As another component of these instructional packages, a Problem Book in mathematics for Class VI was published in 1989. The present Problem Book in mathematics is a sequel to the above book and is meant for the students of Class VII. The purpose of this Problem Book is to supplement the problems given in the textbook to meet the needs of different ability groups of pupils studying in Class VII and thus improve their problem-solving skills.

The draft material for this Problem Book was developed by Prof. Asha Rani Singal (Meerut University), Dr Sunder Lal (Institute of Basic Sciences, Agra University), Prof. J. D. Gupta (Vaishali, Delhi) and Shri Mahendra Shanker (DESM, NCERT). This draft material was then reviewed, refined and supplemented in a workshop held for the purpose at the NIE Campus, New Delhi in September 1988 under the able and expert guidance of Prof. J. N. Kapur. Finally, the material was edited and put into pressworthy form by the Coordinator of this programme, Shri Mahendra Shanker, in consultation with his colleague Dr (Ms) Surja Kumari. Illustrations were prepared by Ms Prem Lata of the DESM. I am thankful to each one of them for their contributions. Special thanks are due to Prof. K. V. Rao, Head, DESM for providing constant guidance in the development of this publication.

The NCERT is particularly interested in finding out how effectively the Problem Book has served its purpose. Suggestions for improvement of the book will be gratefully acknowledged.

Dr K. GOPALAN
Director
National Council of Educational
Research and Training

Preface

LIKE the earlier Problem Book in the series, the aim of the present book also is to provide a selection of problems designed to supplement mathematics textbook for Class VII, Parts I and II. It is divided into six units, viz. Arithmetic, Algebra, Commercial Mathematics, Geometry, Mensuration and Statistics. All types of problems (descriptive as well as objective) have been arranged chapter-wise for each unit. This is to provide variety and coverage of practically all the major concepts and ideas presented in the textbook. This will not only provide a pool of questions to the teachers but is also intended to help them in constructing suitable questions themselves for testing the achievements of their pupils.

The book contains questions of varying degree of hardness including some challenging ones. The questions have not been 'graded' within each chapter so that if students cannot solve the questions, it should not discourage them to attempt some other questions. Some of the questions may appear to be repetitive in the sense that, except for the difference in their forms, the content area tested and the reply expected are the same. This is to assert that the same question could be asked in different forms. In other words, the intention had not been to treat the question as a constituent unit of a single test or a set of tests but to pose a number of questions of different varieties.

Unit tests have been included in the book with two objectives in mind. Firstly, to enable the pupils to evaluate themselves by attempting the tests, and secondly, to serve as model test paper for the teachers.

The last unit entitled 'Some Interesting Problems' includes material which will make mathematics not only useful but also interesting and enjoyable to learn in the classroom.

— COORDINATOR

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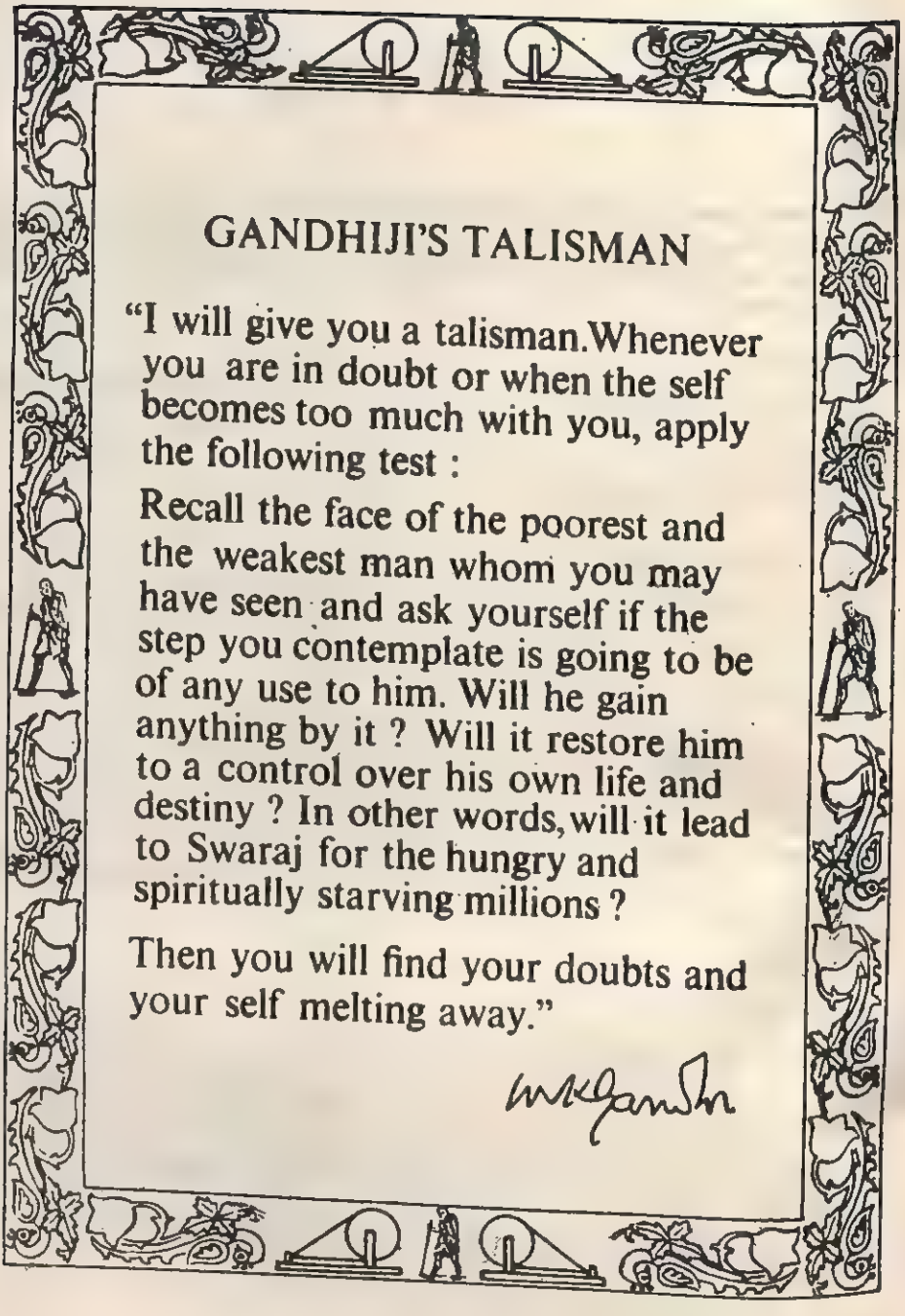


GANDHIJI'S TALISMAN

"I will give you a talisman. Whenever you are in doubt or when the self becomes too much with you, apply the following test :

Recall the face of the poorest and the weakest man whom you may have seen and ask yourself if the step you contemplate is going to be of any use to him. Will he gain anything by it ? Will it restore him to a control over his own life and destiny ? In other words, will it lead to Swaraj for the hungry and spiritually starving millions ?

Then you will find your doubts and your self melting away."

M K Gandhi

Contents

UNIT ONE

Arithmetic

1.1 Rational Numbers

In questions 1 to 10, four alternatives are given for the answers, out of which only one is correct. Choose the correct answer.

1. Which number is in the standard form ?

(a) $\frac{4}{6}$ (b) $\frac{-3}{4}$ (c) $\frac{3}{-4}$ (d) $\frac{-3}{-4}$

2. Which number is a positive rational number ?

(a) $\frac{-5}{6}$ (b) $\frac{5}{-6}$ (c) $\frac{0}{6}$ (d) $\frac{-5}{-6}$

3. The number which is not equal to $\frac{4}{5}$ is

(a) $\frac{40}{50}$ (b) $\frac{-12}{-15}$ (c) $\frac{-4}{-5}$ (d) $\frac{-4}{5}$

4. The two consecutive integers between which $\frac{5}{7}$ lies are

(a) 5 and 6 (b) 0 and 1

(c) 7 and 8 (d) 6 and 8

5. When $\frac{1}{4}$ is written as a rational number with denominator 12, then the numerator would be

(a) 8 (b) – 8 (c) 3 (d) 48

6. If $\frac{5}{8} = \frac{20}{p}$, then the value of p is

(a) 23 (b) – 23 (c) 32 (d) 2

7. Which of the following is not in its lowest terms ?

(a) $\frac{7}{5}$ (b) $\frac{10}{20}$ (c) $\frac{13}{33}$ (d) $\frac{27}{28}$

8. Which of the following is not equal to others ?

(a) $\frac{-3}{-4}$ (b) $\frac{6}{-8}$ (c) $\frac{-3}{4}$ (d) $-\frac{3}{4}$

9. Out of the following rational numbers, which is the greatest ?

(a) $\frac{-5}{6}$ (b) $\frac{5}{7}$ (c) $\frac{5}{4}$ (d) $\frac{5}{-9}$

10. Out of the following rational numbers, which is the smallest ?

(a) $\frac{2}{7}$ (b) $\frac{-5}{7}$ (c) $\frac{4}{-7}$ (d) $\frac{3}{7}$

11. In each of the following, fill in the blanks so as to make the statement true:

(a) A number which can be expressed in the form $\frac{p}{q}$, where p and q are integers and q is not equal to zero, is called a _____ _____.

(b) If the integers p and q have no common divisor other than 1 and q is positive, then the rational number $\frac{p}{q}$ is said to be in the _____ _____.

(c) Two rational numbers are said to be equal if they have the same _____ form.

(d) Geometrically, the rational numbers can be represented on _____ _____

(e) If m is a common divisor of x and y, then

$$\frac{x}{y} = \frac{x \div m}{\ldots}$$

(f) If q and p are positive integers, then $\frac{-p}{q}$ is a ———— rational number.

(g) For each rational number x, exactly one of the following is true:

(i) $x > 0$ (ii) ———— (iii) ————

(h) If x, y, z are rational numbers such that $x > y$ and $y > z$, then ————.

(i) Every positive rational number is ———— zero.

(j) Every negative rational number is ———— zero.

12. Fill in the blanks in each of the following so as to make the statement true:

(a) $1 = \frac{\ldots}{1} = \frac{\ldots}{-5}$ (b) $3 = \frac{\ldots}{1} = \frac{\ldots}{-3}$

(c) $0 = \frac{\ldots}{1} = \frac{\ldots}{-2}$ (d) $-2 = \frac{\ldots}{1} = \frac{\ldots}{-1}$

(e) $\frac{-6}{8} = \frac{\ldots}{8+2}$ (f) $\frac{9}{12} = \frac{9+(-3)}{\ldots}$

(g) $\frac{2}{5} = \frac{2\times(-5)}{\ldots}$ (h) $\frac{-3}{6} = \frac{\ldots}{6\times 6}$

13. Using the correct symbol >, < or = , fill in the blanks in each of the following :

(a) $\frac{2}{3}$ ..... $\frac{6}{8}$ (b) $\frac{7}{6}$ ..... $\frac{3}{7}$

(c) $\frac{4}{1}$ ..... $\frac{4}{7}$ (d) $\frac{9}{3}$ ..... $\frac{1}{8}$

14. Fill in the blanks in each of the following to make the statement true :

(a) The standard form of -1 is ————

(b) Between any two rational numbers, there lie ———— rational numbers as we like.

(c) Between any two integers, there lie ———— rational numbers as we like.

(d) If $\frac{p}{q}$ is a rational number, then q cannot be ———— .

(e) On the number line, the distance between -2 and $\frac{3}{5}$ is ————.

(f) On the number line, the distance between 0 and $\frac{3}{5}$ is ————.

(g) Two rational numbers with different numerators are equal, if their numerators are in the same ———— as their denominators.

15. If x, y and z are any rational numbers, then fill in the blanks in each of the following by choosing appropriate relation from (i) $x < z$, (ii) $x = z$, (iii) $x > z$ and (iv) x and z cannot be compared:

(a) If $x > y$ and $y > z$; then _____.

(b) If $x > y$ and $y < z$, then _____.

(c) If $x < y$ and $y < z$, then _____.

(d) If $x < y$ and $y > z$, then _____.

16. In each of the following state if the statement is true (T) or false (F) :

(i) If $\frac{x}{y}$ is a rational number and m any integer, then $\frac{x}{y} = \frac{x \times m}{y \times m}$.

(ii) Two rational numbers with different numerators cannot be equal.

(iii) If the rational number $\frac{p}{x}$ is greater than the rational number $\frac{p}{y}$ and p, x, y are positive, then x is less than y.

(iv) Every integer is a rational number.

(v) Between any two rational numbers, there lies atleast one integer.

(vi) $\frac{2}{3}$ is equal to $\frac{4}{6}$.

(vii) It is not possible to insert 10000 rational numbers between 1 and 2.

(viii) $\frac{31}{41}$ is equal to $\frac{3}{4}$.

(ix) Every rational number is an integer.

(x) 8 can be written as a rational number with any integer as denominator.

(xi) 8 can be written as a rational number with any integer as numerator.

(xii) If $x > 0$ and $y < 0$, then $x > y$.

17. Select the rational numbers which are integers as well :

$$\frac{9}{3}, \frac{8}{3}, \frac{7}{3}, \frac{6}{3}, \frac{5}{2}, \frac{4}{2}, \frac{3}{1}, \frac{2}{1}, \frac{1}{1}, \frac{0}{1}, \frac{-1}{1}, \frac{-2}{1}, \frac{-3}{2}, \frac{-4}{2}$$

18. Select those which are neither integers nor fractions :

$$2\frac{3}{5}, \frac{5}{1}, \frac{-6}{-9}, \frac{7}{8}, \frac{-3}{4}, \frac{4}{-5}, \frac{-6}{7}$$

19. Select those which can be written as a rational number with denominator 4 :

$$\frac{7}{8}, \frac{64}{16}, \frac{36}{-12}, \frac{-16}{17}, \frac{5}{-4}, \frac{140}{28}$$

20. Select those which can be written as a rational number with numerator 6:

$$\frac{1}{22}, \frac{2}{3}, \frac{3}{4}, \frac{4}{-5}, \frac{5}{6}, \frac{-6}{7}, \frac{-7}{8}$$

21. Write $\frac{-14}{42}$ in a form so that the numerator is equal to

$-2, 7, 42, -70$

22. Select those which cannot be written as a rational number with denominator 10 :

$$\frac{0}{5}, \frac{3}{7}, \frac{6}{5}, \frac{8}{11}, \frac{7}{2}, \frac{9}{9}, \frac{32}{20}, \frac{21}{14}$$

23. Write each of the following in the standard form :

$$4\frac{3}{8}, 7\frac{5}{8}, -8\frac{7}{8}, -9\frac{1}{3}, \frac{-23}{11}, \frac{17}{-23}$$

24. Write the following in the mixed form :

$$\frac{35}{4}, \frac{33}{6}, \frac{47}{5}, \frac{129}{8}, \frac{-93}{13}, \frac{-53}{5}$$

25. Represent all the rational numbers in question 22 on the number line.

26. For each of the rational numbers given in question 24, find the two consecutive integers between which it lies.

27. Write $\frac{1}{4}$ in a form so that the denominator may be equal to

$$20, 36, 44, -80, -100, 40000$$

28. Write $\frac{2}{5}$ in a form so that the numerator may be equal to

$$-56, 154, -750, 500, 6250$$

29. Write in the lowest terms :

$$\frac{2}{10}, \frac{-3}{15}, \frac{-4}{16}, \frac{7}{28}, \frac{15}{35}, \frac{24}{64}, \frac{63}{210}$$

30. In each case, select the greater rational number :

(a) $\frac{2}{3}, \frac{4}{7}$ (b) $\frac{-5}{12}, \frac{4}{12}$

(c) $\frac{-8}{13}, \frac{6}{-9}$ (d) $\frac{-5}{10}, \frac{-4}{-8}$

31. In each case, select the smaller rational number :

(a) $5, \frac{6}{1}$ (b) $-4, \frac{5}{3}$

(c) $0, \frac{9}{-4}$ (d) $100, \frac{789}{100}$

32. Arrange the rational numbers in question 29 in the ascending order.

33. Arrange the rational numbers in question 20 in the descending order.

34. Insert any two rational numbers between

(a) 5 and 6 (b) -1 and 50

(c) $\frac{4}{7}$ and $\frac{87}{15}$ (d) $\frac{5}{4}$ and $\frac{10}{49}$

35. Insert three rational numbers between the pairs of rational numbers given in the previous question.

36. Insert any four rational numbers between

(a) -7 and $\frac{1}{2}$ (b) $-\frac{1}{4}$ and 7

(c) $\frac{4}{-9}$ and $\frac{3}{-4}$ (d) 0 and $\frac{-5}{19}$

1.2 Operations on Rational Numbers

In questions 1 to 7, four alternatives are given for the answers, out of which only one is correct. Choose the correct answer :

1. Sum of the rational numbers $\frac{4}{7}$ and $\frac{-15}{7}$ is

(a) $\frac{19}{7}$ (b) $\frac{-11}{17}$ (c) $\frac{-21}{7}$ (d) $\frac{11}{7}$

2. In which pair, the numbers are not the negatives of each other ?

(a) $\frac{2}{3}, \frac{2}{-3}$ (b) $\frac{-4}{5}, \frac{4}{5}$ (c) $\frac{1}{2}, \frac{-1}{-2}$ (d) 0, 0

3. On subtracting $\frac{-2}{7}$ from $\frac{3}{7}$, we get

(a) $\frac{5}{7}$ (b) $\frac{-5}{7}$ (c) $\frac{1}{7}$ (d) $\frac{-1}{7}$

4. $\frac{3}{4} - \frac{4}{5}$ is not equal to

(a) $\frac{-4}{5} + \frac{3}{4}$ (b) $-\frac{1}{20}$ (c) $\frac{4}{5} - \frac{3}{4}$ (d) $\frac{-4}{5} - (\frac{-3}{4})$

5. The product of $\frac{-1}{2}$ and $\frac{-1}{4}$ is

(a) $\frac{-1}{8}$ (b) $\frac{1}{8}$ (c) $\frac{1}{2}$ (d) 2

6. The reciprocal of $\frac{-1}{9}$ is

(a) 9 (b) –9 (c) $\frac{1}{9}$ (d) $\frac{9}{1}$

7. $\frac{2}{3} \div \frac{-3}{7}$ is equal to

(a) $\frac{-2}{7}$ (b) $\frac{2}{7}$ (c) $\frac{14}{9}$ (d) $\frac{-14}{9}$

8. Fill in the blanks in each of the following so as to make the statemen true :

(a) $\frac{-2}{5} + \left(\frac{3}{7} + \ldots\right) = \left(\ldots + \frac{3}{7}\right) + \frac{4}{5}$

(b) $\frac{6}{5} + \ldots = \frac{-5}{6} + \frac{6}{5}$

(c) $\ldots + 0 = \frac{7}{-9}$

(d) $-(\ldots) = \frac{5}{7}$

9. x, y and z are rational numbers. Fill in the blanks in each of the following so as to make the statement true :

(a) $x + (y + z) = (x + \ldots) + \ldots$

(b) $x + y = y + \ldots$

(c) $x + 0 = \ldots$

(d) $-(-x) = \ldots$

10. Fill in the blanks in each of the following so as to make the statement true :

(a) $\frac{2}{3} - \left(\frac{-3}{8}\right) = \frac{2}{3} + \ldots$

(b) $\frac{3}{8} - \frac{1}{8} = \frac{3}{8} + \ldots$

(c) $0 - \ldots = \frac{-2}{7}$

(d) $\ldots - 0 = \frac{-2}{9}$

(e) $x - y = x + \ldots$, where x, y are rational numbers.

(f) $\frac{1}{3} \times \left(\frac{-2}{7} \times \ldots\right) = \left(\ldots \times \frac{-2}{7}\right) \times \frac{3}{5}$

(g) $\frac{-3}{5} \times \ldots = \frac{6}{7} \times \frac{-3}{5}$

(h) $1 \times \ldots = \frac{-3}{4}$

(i) $\frac{-4}{9} \times \ldots = 0$

(j) $\frac{2}{5} \times \left(\frac{-35}{36} + \ldots\right) = \frac{2}{5} \times \left(\frac{-35}{36}\right) + \ldots \times \frac{5}{7}$

(k) $0 \times x = \ldots$, where x is a rational number.

(l) $x \times 1 = \ldots$, where x is a rational number.

(m) $x \times (y + z) = \ldots + \ldots$, where x, y, z are rational numbers.

11. Recall that x^{-1} denotes the reciprocal of x. Fill in the blanks in each of the following so as to make the statement true :

(a) $\left(\frac{2}{3}\right)^{-1} = \ldots$

(b) $\left(\frac{-5}{7}\right)^{-1} = \ldots$

(c) $(\ldots)^{-1} = \frac{-1}{4}$

(d) $(\ldots)^{-1} = -2$

12. Fill in the blanks in each of the following so as to make the statement true:

(a) $\frac{11}{9} + \frac{-2}{3} = \frac{11}{9} \times \ldots$

(b) $\frac{-7}{5} + \ldots = \frac{-7}{5}$

(c) $\frac{-5}{6} + \ldots = \frac{5}{6}$

(d) $\frac{-2}{3} + \ldots = 1$

(e) $\frac{4}{5} + \left(\frac{-4}{5}\right) = \ldots$

(f) $\frac{-7}{8} + \ldots = -1$

(g) $\left|-\frac{23}{29}\right| = \ldots$

(h) $\left|\frac{2}{7} + \frac{-5}{6}\right| \ldots \left|\frac{2}{7}\right| + \left|\frac{-5}{6}\right|$

(i) $\left|\frac{3}{5} + \frac{1}{6}\right| \ldots \left|\frac{3}{5}\right| + \left|\frac{1}{6}\right|$

(j) $\left|\frac{-3}{7} + \frac{-2}{7}\right| \ldots \left|\frac{-3}{7}\right| + \left|\frac{-2}{7}\right|$

(k) $\left|\frac{3}{10} \times \frac{-5}{8}\right| = \left|\frac{3}{10}\right| \times \ldots$

(l) $\left|\frac{-5}{9}\right| \ldots \left|\frac{5}{9}\right|$

(m) The absolute value of $\frac{2}{9}$ is $\ldots$.

(n) The absolute value of $\frac{-7}{6}$ is $\ldots$.

(o) The absolute value of 0 is . . .

(p) $x + y = x \ldots \frac{1}{y}$, where x is a rational number and y is a non-zero rational number.

(q) $x \div x = \ldots$, where x is a non-zero rational number.

(r) $(-x) \div x = \ldots$, where x is a non-zero rational number.

(s) $|x + y| \ldots |x| + |y|$, where x and y are rational numbers.

(t) $|x \times y| \ldots |x| \times |y|$, where x and y are rational numbers.

13. Fill in the blanks in each of the following so as to make the statement true :

(a) $\frac{5}{8} + \ldots = 2$

(b) $\frac{-7}{8} + \ldots = 4$

(c) $\frac{-3}{11} + \ldots = -5$

(d) $\ldots - \frac{5}{7} = \frac{3}{14}$

(e) $\ldots + \frac{13}{4} = \frac{11}{4}$

(f) $\ldots - \frac{-2}{9} = 0$

(g) $0 + \ldots = \frac{3}{7}$

14. In each of the following, state if the statement is true (T) or false (F) :

(i) The sum of rational numbers $\frac{a}{b}$ and $\frac{c}{d}$ is $\frac{a+c}{b+d}$.

(ii) If x is any rational number, then $x + 0 = x$.

(iii) For every rational number x, $x + 1 = x$.

(iv) Every rational number has a reciprocal.

(v) The reciprocal of a non-zero rational number $\frac{q}{q}$ is the rational number $\frac{q}{p}$.

(vi) If $x + y = 0$, then $-y$ is known as the negative of x, where x and y are rational numbers.

(vii) The negative of the negative of any rational number is the number itself.

(viii) Negative of 0 does not exist.

(ix) The negative of 1 is 1 itself.

(x) For all rational numbers x and y, $x - y = y - x$.

(xi) For all rational numbers x and y, $x \times y = y \times x$.

(xii) For every rational number x, $x \times 0 = x$.

(xiii) For all rational numbers x,y and z,

$x + (y \times z) = (x + y) \times (x + z)$.

(xiv) 1 is the only number which is its own reciprocal.

(xv) -1 is not the reciprocal of any rational number.

(xvi) The reciprocal of x^{-1} is $\frac{1}{x}$.

(xvii) For any rational number x, $x + (-1) = -x$.

(xviii) For all rational numbers x, $x + x = 1$.

(xix) For rational numbers x and y, if $x < y$, then $x - y$ is a positive rational number.

(xx) If x and y are negative rational numbers, then so is $x + y$.

(xxi) Absolute value of the sum of two rational numbers is equal to the sum of their absolute values.

(xxii) Absolute value of the product of two rational numbers is equal to the product of their absolute values.

(xxiii) For every rational number x, the absolute values of x and $-x$ are the same.

(xxiv) Absolute value of every negative rational number is equal to its negative.

(xxv) Absolute value of $\frac{-7}{2}$ is less than 3.

(xxvi) Absolute value of the difference of two rational numbers is equal to the difference of their absolute values.

(xxvii) If x and y are rational numbers such that $y \neq 0$, then the absolute value of $x \div y$ is the same as $|x| \div |y|$.

15. In each of the following, state if the statement is true (T) or false (F) :

(i) $\frac{3}{4}+\left(\frac{-5}{6}+\frac{7}{8}\right)=\left(\frac{3}{4}-\frac{5}{6}\right)+\frac{7}{8}$

(ii) $\frac{11}{5}+\frac{-6}{7}=\frac{-6}{7}+\frac{11}{5}$

(iii) $\frac{2}{3}-\left(\frac{5}{6}-\frac{1}{6}\right)=\left(\frac{2}{3}-\frac{5}{6}\right)-\frac{1}{6}$

(iv) $\frac{3}{5}-\frac{3}{7}=\frac{3}{7}-\frac{3}{5}$

(v) $0-\frac{2}{9}=\frac{2}{9}$

(vi) $\frac{6}{7}-0=\frac{6}{7}$

(vii) $0+\frac{-5}{7}=\frac{5}{7}$

(viii) $-\left(-\frac{5}{7}\right)=\frac{5}{7}$

(ix) $\frac{3}{8}+\left(\frac{-5}{8}+\frac{5}{2}\right)=\left(\frac{3}{8}+\frac{-5}{8}\right)+\frac{5}{2}$

(x) $1+\frac{5}{9}=\frac{5}{9}$

(xi) $-\frac{2}{7}+1=-\frac{2}{7}$

(xii) $\frac{12}{37} \times \frac{54}{31} = \frac{54}{31} \times \frac{12}{37}$

(xiii) $\left(\frac{23}{15} \times \frac{11}{16}\right) \times \frac{5}{1} = \frac{23}{15} \times \left(\frac{11}{16} \times \frac{5}{1}\right)$

(xiv) $0 \times \frac{1234}{9999} = 0$

(xv) $-\frac{2}{9} + \frac{1}{3} = \frac{1}{3} + \frac{-2}{9}$

(xvi) $1 \times \frac{987}{101} = \frac{987}{101}$

(xvii) $\frac{2}{3} \times \left(\frac{-87}{180} + \frac{993}{105}\right) = \frac{2}{3} \times \frac{-87}{180} + \frac{2}{3} \times \frac{993}{105}$

(xviii) $\left|\frac{2}{3} + \frac{-3}{4}\right| = \left|\frac{2}{3}\right| + \left|\frac{-3}{4}\right|$

(xix) $\left|\frac{2}{7} \times \frac{-3}{4}\right| = \left|\frac{2}{7}\right| \times \left|\frac{-3}{4}\right|$

(xx) $\left|\frac{3}{5} - \frac{-2}{7}\right| = \left|\frac{3}{5}\right| - \left|\frac{-2}{7}\right|$

(xxi) $\left|\frac{3}{5} - \frac{2}{7}\right| = \left|\frac{3}{5}\right| - \left|\frac{2}{7}\right|$

(xxii) $\left|\frac{2}{3} + \frac{3}{4}\right| = \left|\frac{2}{3}\right| + \left|\frac{3}{4}\right|$

16. Add :

(a) $\frac{-2}{3}$ and $\frac{5}{3}$

(b) $\frac{-3}{5}$ and $\frac{-6}{5}$

(c) $\frac{-7}{4}$ and $\frac{9}{8}$

(d) $\frac{5}{12}$ and $\frac{-7}{18}$

17. Express the sum in lowest terms :

(a) $\frac{11}{12} + \frac{-1}{4}$

(b) $\frac{-3}{10} + \frac{9}{5}$

(c) $\frac{-5}{12} + \frac{-1}{4}$ (d) $\frac{8}{21} + \frac{9}{14}$

18. Add and express the sum as a mixed fraction :

(a) $\frac{-12}{5}$ and $\frac{43}{10}$ (b) $\frac{24}{7}$ and $\frac{-11}{14}$

(c) $\frac{-31}{6}$ and $\frac{-27}{8}$ (d) $\frac{101}{6}$ and $\frac{7}{8}$

19. Express as a rational number of the form $\frac{p}{q}$:

(a) $\frac{3}{4} + \frac{5}{6} + \frac{-7}{8}$ (b) $\frac{2}{3} + \frac{-5}{6} + \frac{-7}{9}$

(c) $\frac{-11}{2} + \frac{7}{6} + \frac{-5}{8}$ (d) $\frac{-4}{5} + \frac{-7}{10} + \frac{-8}{15}$

20. Rearrange suitably and find the sum :

(a) $\frac{3}{5} + \frac{-7}{6} + \frac{2}{5} + \frac{-5}{6}$

(b) $\frac{-8}{3} + \frac{-1}{4} + \frac{-11}{6} + \frac{3}{8}$

(c) $\frac{11}{2} + \frac{-17}{3} + \frac{-25}{2} + \frac{11}{12}$

(d) $\frac{-6}{7} + \frac{-4}{9} + \frac{-15}{7} + \frac{-5}{6}$

21. Simplify and write as a rational number of the form $\frac{p}{q}$:

(a) $\frac{3}{5} + \frac{7}{3} + \frac{-13}{15} + \frac{9}{5} + \frac{-7}{3}$

(b) $\frac{6}{7} + 1 + \frac{-7}{9} + \frac{-12}{7} + \frac{19}{21}$

(c) $\frac{15}{2} + \frac{-11}{3} + 6 + \frac{-7}{6} + \frac{9}{8}$

(d) $\frac{-7}{4} + 0 + \frac{-9}{5} + \frac{11}{4} + \frac{19}{10}$

22. Subtract :

(a) $\frac{2}{3}$ from $\frac{7}{3}$ (b) $\frac{4}{3}$ from $\frac{-5}{6}$

(c) $\frac{-7}{2}$ from $\frac{7}{8}$ (d) $\frac{-3}{5}$ from $\frac{7}{10}$

23. Write the negatives of :

(a) $\frac{2}{3}, \frac{11}{17}, \frac{6}{1}$ and $\frac{105}{253}$

(b) $\frac{-2}{5}, \frac{7}{-9}, \frac{-16}{13}$ and $\frac{-5}{1}$

(c) 0, 1 and – 1

24. Find the value of :

(a) $\frac{17}{4} - \frac{3}{4}$ (b) $\frac{15}{4} - \frac{7}{6}$

(c) $\frac{-8}{9} - \frac{5}{6}$ (d) $\frac{-7}{11} - \frac{-5}{22}$

(e) $\frac{5}{7} - \frac{-2}{21}$ (f) $6 - \frac{3}{8}$

(g) $\frac{25}{7} - 0$ (h) $0 - \frac{14}{-9}$

25. Simplify :

(a) $\frac{-3}{2} + \frac{5}{4} - \frac{7}{4}$ (b) $\frac{5}{3} - \frac{7}{6} + \frac{-2}{3}$

(c) $\frac{5}{4} - \frac{7}{6} - \frac{-2}{3}$ (d) $\frac{-2}{5} - \frac{-3}{10} - \frac{-4}{7}$

26. Evaluate :

(a) $\frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \ldots$ eight times.

(b) $\frac{-2}{3} + \frac{-2}{3} + \frac{-2}{3} + \ldots$ eleven times.

(c) $1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} + \ldots$ twenty times.

(d) $\left(-1\frac{2}{3}\right) + \left(-1\frac{2}{3}\right) + \left(-1\frac{2}{3}\right) + \ldots$ fifteen times.

27. Find the product of :

(a) $\frac{2}{3}$ and $\frac{7}{8}$ (b) $\frac{2}{5}$ and $\frac{-7}{9}$

(c) $\frac{-3}{7}$ and $\frac{14}{9}$ (d) $\frac{-5}{4}$ and $\frac{-12}{105}$

28. Multiply :

(a) $\frac{4}{7}$ by $\frac{-21}{16}$ (b) $\frac{-13}{5}$ by $\frac{15}{7}$

(c) -5 by $\frac{1}{4}$ (d) $\frac{-2}{3}$ by 1

(e) $\frac{17}{18}$ by -1 (f) 0 by $\frac{1}{2}$

29. Express as a rational number in standard form :

(a) $\frac{-5}{3} \times \frac{-7}{15}$ (b) $\frac{2}{-3} \times \frac{4}{5}$

(c) $\frac{15}{2} \times \frac{17}{-5}$ (d) $\frac{10}{-19} \times 57$

30. Divide :

(a) 1 by $\frac{1}{2}$ (b) 5 by $-\frac{5}{7}$

(c) $\frac{3}{4}$ by $\frac{9}{16}$ (d) $\frac{7}{8}$ by $-\frac{21}{16}$

(e) $\frac{7}{-4}$ by 1 (f) 0 by $\frac{1}{4}$

31. Find the value and express as a rational number in standard form :

(a) $\frac{1}{5} + \frac{13}{15}$ (b) $\frac{2}{3} \div \frac{-7}{12}$

(c) $-6 \div \left(\frac{-8}{17}\right)$ (d) $\frac{40}{99} \div (-20)$

(e) $-\frac{11}{27} \div -\frac{55}{18}$ (f) $\frac{-36}{25} \div \frac{-3}{15}$

32. Write the absolute values of the following :

$\frac{1}{2}, -5, 0, \frac{-3}{7}, \frac{6}{5}, \frac{-3}{-4}, \frac{3}{5}, \frac{-17}{8}$

33. Find all rational numbers whose absolute value is

(a) $\frac{1}{2}$ (b) 0

34. Find all rational numbers whose absolute values are less than

(a) 4 (b) $\frac{1}{4}$

35. Verify the property $x + (y + z) = (x + y) + z$ of rational numbers by taking

(a) $x = \frac{-1}{2}, y = \frac{3}{4}, z = \frac{5}{8}$

(b) $x = \frac{-1}{2}, y = \frac{2}{3}, z = \frac{3}{4}$

(c) $x = \frac{-2}{3}, y = \frac{-4}{6}, z = \frac{-7}{9}$

(d) $x = \frac{-1}{5}, y = \frac{2}{15}, z = \frac{-3}{10}$

36. Verify the property $x + y = y + x$ of rational numbers by taking

(a) $x = \frac{1}{2}, y = \frac{7}{2}$

(b) $x = \frac{-2}{3}, y = \frac{5}{6}$

(c) $x = \frac{-3}{7}, y = \frac{20}{21}$

(d) $x = \frac{-2}{5}, y = \frac{-9}{10}$

37. The sum of two rational numbers is -5. If one of the numbers is $\frac{5}{6}$, then find the other.

38. The sum of two numbers is $\frac{13}{16}$. If one of the numbers is $\frac{7}{8}$, find the other.

39. What should be added to $\frac{33}{16}$ so as to get $\frac{73}{32}$?

40. What should be added to -3 so as to get $\frac{-16}{9}$?

41. Simplify :

(a) $\left(\frac{1}{2} \times \frac{1}{4}\right) + \left(\frac{1}{2} \times 6\right)$

(b) $\left(-5 \times \frac{2}{15}\right) - \left(-6 \times \frac{2}{9}\right)$

(c) $\left(-\frac{7}{18} \times \frac{15}{-7}\right) - \left(1 \times \frac{1}{4}\right) + \left(\frac{1}{2} \times \frac{1}{4}\right)$

42. Verify the property $x \times y = y \times x$ of rational numbers by taking

(a) $x = 7$ and $y = \frac{1}{2}$

(b) $x = \frac{2}{3}$ and $y = \frac{9}{4}$

(c) $x = \frac{-5}{7}$ and $y = \frac{14}{15}$

(d) $x = \frac{-3}{8}$ and $y = \frac{-4}{9}$

43. Verify the property $x \times (y \times z) = (x \times y) \times z$ of rational numbers by taking

(a) $x = 1$, $y = \frac{1}{2}$ and $z = \frac{1}{4}$

(b) $x = \frac{2}{3}$, $y = \frac{-3}{7}$ and $z = \frac{1}{2}$

(c) $x = \frac{-2}{7}$, $y = \frac{-5}{6}$ and $z = \frac{1}{4}$

(d) $x = 0, y = \frac{1}{2}$ and $z = \frac{1}{4}$

44. Verify the property $x \times (y + z) = x \times y + x \times z$ of rational numbers by taking the values of x, y, and z as given in question 43.

45. Use the distributivity of multiplication of rational numbers over their addition to simplify :

(a) $\frac{3}{5} \times \left(\frac{35}{24} + \frac{10}{1}\right)$ (b) $\frac{-5}{4} \times \left(\frac{8}{5} + \frac{16}{15}\right)$

(c) $\frac{2}{7} \times \left(\frac{7}{16} - \frac{21}{4}\right)$ (d) $\frac{3}{4} \times \left(\frac{8}{9} - 40\right)$

46. The product of two rational numbers is 15. If one of the numbers be -10, find the other.

47. The product of two rational numbers is $-\frac{13}{18}$. If one of the numbers is $\frac{-5}{12}$, then find the other.

48. By what number should we multiply $\frac{-1}{6}$ so that the product may be $\frac{-23}{9}$?

49. By what number should $\frac{-3}{4}$ be multiplied in order to produce $\frac{2}{3}$?

50. Simplify :

(a) $\frac{30}{11} \div \frac{33}{5} \times \frac{22}{15}$ (b) $\frac{3}{7} \times \frac{28}{15} + \frac{14}{5}$

(c) $\frac{3}{7} \div \frac{-2}{21} + \frac{-5}{6}$ (d) $\frac{7}{8} + \frac{21}{16} - \frac{1}{12}$

51. Verify that $|x + y| \leq |x| + |y|$ by taking

(a) $x = -\frac{1}{2}$ and $y = \frac{1}{4}$

(b) $x = \frac{-8}{13}$ and $y = -7$

(c) $x = \frac{13}{4}$ and $y = \frac{3}{4}$

52. Verify that $|x \times y| = |x| \times |y|$ by taking

(a) $x = \frac{1}{2}$ and $y = -\frac{1}{4}$

(b) $x = -\frac{1}{2}$ and $y = -6$

1.3 Exponents

In questions 1 to 21, four alternatives are given for the answers, out of which only one is correct. Choose the correct answer :

1. Square of $\left(\frac{-2}{3}\right)$ is

(a) $-\frac{2}{3}$ (b) $\frac{2}{3}$

(c) $\frac{-4}{9}$ (d) $\frac{4}{9}$

2. Cube of $\frac{-1}{4}$ is

(a) $\frac{-1}{4}$ (b) $\frac{1}{16}$

(c) $\frac{-1}{64}$ (d) $\frac{1}{64}$

3. Which of the following is not equal to $\left(\frac{-3}{4}\right)^4$?

(a) $\frac{(-3)^4}{4^4}$ (b) $\frac{3^4}{(-4)^4}$

(c) $-\frac{3^4}{4^4}$ (d) $\left(-\frac{3}{4}\right) \times \left(-\frac{3}{4}\right) \times \left(-\frac{3}{4}\right) \times \left(-\frac{3}{4}\right)$

4. Out of the following, the number which is not equal to $\frac{-8}{27}$ is

(a) $\left(\frac{2}{3}\right)^{-3}$ (b) $-\left(\frac{2}{3}\right)^3$

(c) $\left(-\frac{2}{3}\right)^3$ (d) $\left(-\frac{2}{3}\right) \times \left(-\frac{2}{3}\right) \times \left(-\frac{2}{3}\right)$

5. Which of the following is not the reciprocal of $\left(\frac{2}{3}\right)^4$?

(a) $\left(\frac{3}{2}\right)^4$ (b) $\left(\frac{2}{3}\right)^{-4}$

(c) $\left(\frac{3}{2}\right)^{-4}$ (d) $\frac{3^4}{2^4}$

6. $\left(\frac{2}{3}\right)^{-5}$ is equal to

(a) $\left(-\frac{2}{3}\right)^5$ (b) $\left(\frac{3}{2}\right)^5$

(c) $\frac{2 \times (-5)}{3}$ (d) $\frac{2}{3 \times 5}$

7. $\left(-\frac{1}{2}\right)^5 \times \left(-\frac{1}{2}\right)^3$ is equal to

(a) $\left(-\frac{1}{2}\right)^8$ (b) $-\left(\frac{1}{2}\right)^8$

(c) $\left(\frac{1}{4}\right)^8$ (d) $\left(-\frac{1}{2}\right)^{15}$

8. $\left(-\frac{1}{3}\right)^3 \div \left(-\frac{1}{3}\right)^8$ is equal to

(a) $\left(-\frac{1}{3}\right)^5$ (b) $\left(-\frac{1}{3}\right)^{11}$

(c) $(-3)^5$ (d) $\left(\frac{1}{3}\right)^5$

9. $\left(-\frac{1}{4}\right)^6 \div \left(-\frac{1}{4}\right)^2$ is equal to

(a) $\left(-\frac{1}{4}\right)^3$ (b) $\left(\frac{1}{4}\right)^3$

(c) $\left(-\frac{1}{4}\right)^4$ (d) $-\left(\frac{1}{4}\right)^4$

10. $\left[\left(\frac{1}{2}\right)^2\right]^3$ is equal to

(a) $\left(\frac{1}{2}\right)^8$ (b) $\left(\frac{1}{2}\right)^6$

(c) $\left(\frac{1}{2}\right)^5$ (d) $\left(\frac{1}{2}\right)^{23}$

11. $\left(\frac{1}{2}\right)^0$ is equal to

(a) 0 (b) $\frac{1}{2}$

(c) 1 (d) 5

12. $\left(-\frac{2}{3}\right)^{-1}$ is equal to

(a) $\frac{2}{3}$ (b) $\frac{3}{2}$

(c) $-\frac{5}{3}$ (d) $\frac{-3}{2}$

13. $\left(\frac{2}{3}\right)^{-3} \times \left(\frac{5}{7}\right)^{-3}$ is equal to

(a) $\left(\frac{2}{3} \times \frac{5}{7}\right)^{-3}$ (b) $\left(\frac{2}{3} \times \frac{5}{7}\right)^{-6}$

(c) $\left(\frac{2}{3} \times \frac{5}{7}\right)^6$ (d) $\left(\frac{2}{3} \times \frac{5}{7}\right)^9$

14. $\left(\frac{3}{5}\right)^4 + \left(\frac{2}{3}\right)^4$ is equal to

(a) $\left(\frac{3}{5} + \frac{2}{3}\right)^1$ (b) $\left(\frac{3}{5} + \frac{2}{3}\right)^4$

(c) $\left(\frac{3}{5} + \frac{2}{3}\right)^0$ (d) $\left(\frac{3}{5} + \frac{2}{3}\right)^8$

15. If x is a non-zero rational number, then $x^{-3} \times x^2$ is equal to

(a) x^{-1} (b) x^{-6}

(c) x^{-32} (d) x^9

16. For a non-zero rational number x, $(x^2)^{-3}$ is equal to

(a) x^{-1} (b) x^{-6}

(c) x^{-23} (d) x^8

17. For a non-zero rational number x, $x^8 + x^2$ is equal to

(a) x^4 (b) x^{-4}

(c) x^6 (d) x^{10}

18. For a non-zero rational number x, $x^3 + x^5$ is equal to

(a) x^{-8} (b) $\frac{1}{x^2}$

(c) x^2 (d) x^8

19. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the

(a) second power of x

(b) third power of x

(c) fifth power of x

(d) sixth power of x

20. For any two rational numbers x and y, $x^3 \times y^3$ is equal to

(a) $(x \times y)^0$ (b) $(x \times y)^3$

(c) $(x \times y)^6$ (d) $(x \times y)^9$

21. For any two non-zero rational numbers x and y, $x^5 \div y^5$ is equal to

(a) $(x \div y)^1$ (b) $(x \div y)^0$

(c) $(x \div y)^5$ (d) $(x \div y)^{10}$

22. Fill in the blanks in each of the following so as to make the statement true :

(a) $\left(\frac{5}{2}\right)^{21} \times \left(\frac{5}{2}\right)^{3} = \left(\frac{5}{2}\right)^{\cdots}$

(b) $\left(-\frac{2}{3}\right)^{31} \times \left(-\frac{2}{3}\right)^{13} = \left(-\frac{2}{3}\right)^{\cdots}$

(c) $\left(\frac{1}{4}\right)^{70} \div \left(\frac{1}{4}\right)^{5} = \left(\frac{1}{4}\right)^{\cdots}$

(d) $\left(-\frac{1}{2}\right)^{15} \div \left(-\frac{1}{2}\right)^{4} = \left(-\frac{1}{2}\right)^{\cdots}$

(e) $\left(\frac{5}{7}\right)^{2} \div \left(\frac{5}{7}\right)^{4} = \left(\frac{7}{5}\right)^{\cdots}$

(f) $\left(\frac{-3}{4}\right)^{3} \div \left(\frac{-3}{4}\right)^{10} = \left(\frac{-4}{3}\right)^{\cdots}$

(g) $\left(\frac{1}{2}\right)^{4} \times (\ldots)^{5} = \left(\frac{1}{2}\right)^{9}$

(h) $\left(-\frac{1}{4}\right)^{3} \times \left(-\frac{1}{4}\right)^{\cdots} = \left(-\frac{1}{4}\right)^{11}$

(i) $\left(\frac{13}{14}\right)^5 + (\ldots)^2 = \left(\frac{13}{14}\right)^3$

(j) $\left(\frac{-7}{18}\right)^{\cdots} \div \left(\frac{-7}{18}\right)^4 = \left(\frac{-7}{18}\right)^3$

(k) $\left(\left(\frac{1}{2}\right)^2\right)^3 = \left(\frac{1}{2}\right)^{\cdots}$

(l) $\left(\left(\frac{-1}{4}\right)^{32}\right)^2 = \left(-\frac{1}{4}\right)^{\cdots}$

23. In each of the following, state if the statement is true (T) or false (F) :

(i) $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

(ii) $\left[\left(\frac{2}{3}\right)^3\right]^5 = \left(\frac{2}{3}\right)^{15}$

(iii) $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

(iv) $\left(\frac{2}{5}\right)^5 \div \left(\frac{3}{5}\right)^5 = \left(\frac{2}{5} \div \frac{3}{5}\right)^0$

(v) $\left(\frac{3}{7}\right)^3 \times \left(\frac{2}{7}\right)^3 = \left(\frac{3}{7} \times \frac{2}{7}\right)^3$

(vi) $\left(\frac{2}{3}\right)^5 \times \left(\frac{4}{7}\right)^5 = \left(\frac{2}{3} + \frac{4}{7}\right)^5$

(vii) $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^5$

(viii) $x^m \times y^m = (x \times y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

(ix) $x^m + y^m = (x + y)^m$, where x and y are non-zero rational numbers and m is a positive integer.

(x) $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are positive integers.

24. Express as a rational number of the form $\frac{p}{q}$:

(a) $\left(\frac{3}{7}\right)^2$ (b) $\left(\frac{7}{9}\right)^3$

(c) $\left(-\frac{2}{3}\right)^2$ (d) $\left(-\frac{3}{5}\right)^3$

25. Use power notation to write in a short form :

(a) $\left(\frac{2}{3}\right) \times \left(\frac{2}{3}\right) \times \left(\frac{2}{3}\right)$

(b) $\left(\frac{4}{3}\right) \times \left(\frac{4}{3}\right) \times \left(\frac{4}{3}\right) \times \left(\frac{4}{3}\right) \times \left(\frac{4}{3}\right)$

(c) $\left(\frac{-5}{2}\right) \times \left(\frac{-5}{2}\right) \times \left(\frac{-5}{2}\right) \times \left(\frac{-5}{2}\right)$

(d) $\left(-\frac{10}{3}\right) \times \left(-\frac{10}{3}\right) \times \left(-\frac{10}{3}\right) \times \left(-\frac{10}{3}\right) \times \left(-\frac{10}{3}\right) \times \left(-\frac{10}{3}\right)$

26. Find the value of :

(a) $\left(\frac{1}{4}\right)^3 \times \left(\frac{1}{2}\right)^2$ (b) $\left(\frac{15}{7}\right)^3 \times \left(\frac{7}{12}\right)^2$

(c) $\left(\frac{-2}{5}\right)^3 \div \left(\frac{-3}{10}\right)^4$ (d) $(-3)^4 \times \left(\frac{-5}{12}\right)^2$

27. Express in power notation :

(a) $\frac{49}{64}$ (b) $\frac{9}{25}$

(c) $\frac{27}{64}$ (d) $\frac{64}{125}$

(e) $\frac{-27}{8}$ (f) $\frac{-1}{216}$

28. Simplify :

(a) $\left(\frac{1}{4}\right)^3 \div \left(-\frac{1}{2}\right)^3$

(b) $(-2)^3 \times \left(-\frac{1}{4}\right)^2 \times \left(\frac{1}{2}\right)^2$

29. Find the reciprocals of :

(a) $(-5)^3$

(b) $\left(\frac{3}{4}\right)^2$

(c) $\left(\frac{-6}{7}\right)^2$

(d) $\left(\frac{-2}{3}\right)^3$

30. Find the value of :

(a) 5^0

(b) $(-6)^0$

(c) $\left(\frac{1}{2}\right)^{7-7}$

(d) $\left(-\frac{1}{4}\right)^{2\times5-10}$

(e) $3^0 + 4^0$

(f) $7^0 \times 8^0$

(g) $\left(\frac{7}{8}\right)^0 - \left(\frac{-5}{7}\right)^0 + \left(\frac{-4}{9}\right)^0$

(h) $\left(\frac{6}{5}\right)^0 + \left(\frac{6}{5}\right)^0 \times \left(\frac{6}{5}\right)^0 - \left(\frac{6}{5}\right)^0$

31. Express in the form $\frac{p}{q}$:

(a) $(6)^{-1}$

(b) $(-7)^{-1}$

(c) $\left(\frac{1}{4}\right)^{-1}$

(d) $\left(-\frac{1}{2}\right)^{-1}$

32. Express as a rational number of the form $\frac{p}{q}$:

(a) 5^{-3}

(b) $(-2)^{-5}$

(c) $\left(\frac{1}{4}\right)^{-4}$

(d) $\left(\frac{4}{3}\right)^{-3}$

(e) $\left(\frac{-2}{5}\right)^{-4}$ (f) $\left(\frac{-3}{5}\right)^{-3}$

(g) $\left(\frac{3}{8}\right)^{-2} \times \left(\frac{4}{5}\right)^{-3}$ (h) $\left(\frac{-2}{7}\right)^{-4} \div \left(\frac{-5}{7}\right)^{-2}$

33. Express as a power of a rational number with positive exponent :

(a) $\left(\frac{1}{4}\right)^{-3}$ (b) $\left(-\frac{1}{2}\right)^{-6}$

(c) $5^{-3} \times 5^{-6}$ (d) $\left(-\frac{1}{4}\right)^{-5} \times \left(-\frac{1}{4}\right)^{-7}$

(e) $\left(\left(-\frac{3}{2}\right)^{2}\right)^{-3}$ (f) $(2^{-5} \div 4^{2}) \times 8^{-1}$

34. Express as a power of a rational number with negative exponent :

(a) $\left(\frac{8}{9}\right)^{7}$ (b) $\left(\frac{-5}{23}\right)^{8}$

(c) $\left(-\frac{1}{2}\right)^{5}\left(-\frac{1}{2}\right)^{6}$ (d) $\left(\left(\frac{1}{4}\right)^{2}\right)^{7}$

(e) $(-2)^{4}\left(\frac{3}{4}\right)^{2}$ (f) $\left(-\frac{1}{2}\right)^{3}\left(\frac{1}{2}\right)^{2}$

35. For which number x, x^0 is not defined ?

36. For what values of p and q, the relation $\left(\frac{p}{q}\right)^{-m} = \left(\frac{q}{p}\right)^{m}$ is not meaningful?

37. Simplify and express as a power of a rational number :

(a) $\left(\frac{4}{3}\right)^{2} \times \left(\frac{2}{3}\right)^{3} \times \frac{1}{4}$

(b) $\left(\frac{2}{3}\right)^3 \times \left(-\frac{6}{7}\right)^2 \times \left(-\frac{7}{4}\right) \times \frac{3}{2}$

(c) $\left(-\frac{4}{5}\right)^2 \times \left(\frac{125}{64}\right) \times \frac{15}{2} \times \frac{1}{6}$

(d) $-\left(\frac{2}{5}\right)^2 \times \left(\frac{5}{7}\right)^2 \times \frac{49}{5} + \left(-\frac{4}{5}\right)^3 \times \frac{5}{4} \times \frac{3}{4}$

38. Express as a rational number of the form $\frac{p}{q}$:

(a) $(2^{-1} + 3^{-1})^2$

(b) $(2^{-1} \times 5^{-1})^4$

(c) $(2^{-1} - 4^{-1})^2$

(d) $\left(\frac{3}{2}\right)^{-1} + \left(\frac{-2}{5}\right)^{-1}$

(e) $\left[\left(\frac{1}{2}\right)^{-1} \times (-4)^{-1}\right]^{-1}$

(f) $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$

39. By what number should 5^{-1} be multiplied so that the product may be equal to $(-7)^{-1}$?

40. By what number should $\left(\frac{1}{2}\right)^{-1}$ be multiplied so that the product may be equal to $\left(\frac{-4}{7}\right)^{-1}$?

41. By what number should $(-15)^{-1}$ be divided so that the quotient may be equal to $(-5)^{-1}$?

42. By what number should $(-8)^{-3}$ be multiplied so that the product may be equal to $(-6)^{-3}$?

43. By what number should $\left(-\frac{3}{2}\right)^{-3}$ be divided so that the quotient may be $\left(\frac{4}{27}\right)^{-2}$?

44. Find x if $\left(\frac{1}{4}\right)^{-4} \times \left(\frac{1}{4}\right)^{-8} = \left(\frac{1}{4}\right)^{-4x}$

45. Find y if $\left(-\frac{1}{2}\right)^{-19} \div \left(-\frac{1}{2}\right)^{8} = \left(-\frac{1}{2}\right)^{-2y+1}$.

46. Express $\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$ in the form $\frac{p}{q}$.

1.4 Decimal Representation of Rational Numbers

In questions 1 to 11, four alternatives are given for the answers, out of which only one is correct. Choose the correct answer :

1. The number of digits in the decimal part of $22.44\dot{4}$ is

(a) 2 (b) 3 (c) 4 (d) not finite

2. The number which can be represented as a terminating decimal is

(a) $\frac{1}{6}$ (b) $\frac{1}{12}$ (c) $\frac{1}{15}$ (d) $\frac{1}{20}$

3. $0.\overline{7}$ is

(a) a terminating decimal.

(b) a non-terminating recurring decimal.

(c) a non-terminating non-recurring decimal.

(d) not a decimal at all.

4. The number which cannot be represented as a terminating decimal is

(a) $\frac{1}{4}$ (b) $\frac{1}{8}$ (c) $\frac{1}{10}$ (d) $\frac{1}{6}$

5. The number which is not a repeating decimal is

(a) 0.10101010...

(b) 0.22202020...

(c) 2.001002003004...

(d) – 2.27373737...

6. Which of the following is in the scientific notation ?

(a) 0.9×10^3 (b) 0.09×10^{-3}

(c) 9.9×10^4 (d) 0.9×10^{-3}

7. Which of the following is not in the scientific notation ?

(a) 2.3×10^5 (b) 3.9×10^{-6}

(c) 0.5×10^7 (d) 1.5×10^6

8. 3.5×10^{-6}, written in expanded form, equals

(a) 3.5000000 (b) .00000035

(c) .0000035 (d) $3.5 \times 10 - 6$

9. .7499 lies between

(a) .7 and .74 (b) .75 and .79

(c) –.749 and –.75 (d) .74 and .75

10. .023 lies between

(a) .2 and .3 (b) .03 and .02

(c) –.02 and .03 (d) – .03 and .02

11. Which of the following is not equal to $\frac{1}{2}$?

(a) 5×10^{-1} (b) 0.5×10^{-1}

(c) 0.05×10 (d) $.005 \times 10^2$

12. Fill in the blanks in each of the following so as to make the statement true :

(a) The decimal representation of a rational number is either-------- or ---------- .

(b) $\frac{p}{q}$ is the standard form of a rational number x. The decimal representation of x is terminating if q has no prime factors other than ----------.

(c) The number of digits in the decimal part of a non-terminating decimal is ---------- .

(d) A number is said to be written in the scientific notation, if it is expressed as $k \times 10^n$, where k is a decimal such that ---------- and n is ---------- .

(e) Only ---------- decimals can be written in the scientific notation.

13. In each of the following, state if the statement is true (T) or false (F) :

(i) $\frac{1}{8}$ can be represented as a terminating decimal.

(ii) $\frac{1}{6}$ can be represented as a terminating decimal.

(iii) The number of digits in the decimal part of a non-terminating decimal is finite.

(iv) The number 1.9×10^{-3} is written in scientific notation.

(v) If the denominator of a rational number written in standard form has prime factors other than 2 and 5, then this rational number cannot be written as a terminating decimal.

14. Which of the following rational numbers can be represented as terminating decimals ?

$$\frac{1}{6}, \frac{-2}{5}, \frac{4}{7}, \frac{-8}{9}, \frac{13}{15}, \frac{15}{20}, -\frac{11}{20}, -\frac{73}{8}$$

15. Which of the following rational numbers can be represented only as non-terminating repeating decimals ?

$$\frac{1}{12}, \frac{36}{15}, \frac{31}{10}, \frac{-137}{125}, \frac{771}{640}, 10^{-5}, -2^{-15}, 3^{-3}$$

16. Write each of the following numbers using scientific notation :

(a) 0.000000000032

(b) 0.000000001234

(c) 6.300000000000

(d) 15430000000000

(e) Nine million seven hundred fifty thousand five

(f) Thirteen crores nine lakhs six hundred seventy-two

17. Which of the following, if any, represent rational numbers ?

(a) 0.001002003004...

(b) 2.342342342342...

(c) 5.717771777717777...

(d) 2.565030303...

(e) 7.6543217654321765432176543217...

18. Write each of the following numbers in the usual form :

(a) 3.7×10^6 (b) 6.9×10^{-8}

(c) 1.64×10^9 (d) 7.85×10^{-7}

(e) 23.8×10^{15} (f) 30.7×10^{-19}

19. Express each of the following as a decimal :

$\frac{1}{2}, \frac{1}{4}, \frac{3}{4}, \frac{1}{8}, \frac{-1}{10}, \frac{-2}{5}, \frac{3}{5}, \frac{3}{8}, \frac{-7}{10}, \frac{-9}{25}$

20. Find the decimal representation of each of the following :

$\frac{1}{3}, \frac{2}{3}, \frac{-4}{9}, \frac{-2}{15}, \frac{5}{6}, \frac{-4}{7}$

21. Express each of the following decimals as a rational number in lowest terms :

.13, .230, 3.14, 5.07, 7.100, 9.990, 0.999, 99.90, 10.10, 10.1000, –.35, –5.2

22. Convert each of the following decimals into the form $\frac{p}{q}$:

$0.\overline{6}, 0.\overline{13}, 0.\overline{45}, 0.\overline{50}, 1.\overline{34}, 1.1\overline{21}$

23. Exactly how many numbers lying between 0 and 1 have at the most two digits in their decimal representation ?

24. How many numbers lying between 0 and 1 have exactly two digits in their decimal representation ?

25. Express each of the following in the form $\frac{p}{q}$:

(a) $31.\overline{3} + 7.\overline{3}$

(b) $3.\overline{9} - 0.\overline{6}$

(c) $0.\overline{2} + 0.\overline{8}$

(d) $0.\overline{3} + 1.3\overline{1}$

26. Write 149 rational numbers between $\frac{1}{4}$ and $\frac{1}{2}$.

27. Write each of the following numbers as a terminating as well as a non-terminating decimal. The non-terminating representation should not end in a sequence of zeros.

$\frac{3}{5}, \frac{13}{10}, \frac{117}{5}, \frac{131}{5}, \frac{359}{100}$

UNIT TWO

Algebra

2.1 Algebraic Expressions

In questions 1 to 10, four alternatives are given for answers, out of which only one is correct. Choose the correct answer :

1. The value of the expression $3x^2 - 6x + 7$ for $x = 2$ is

   (a) $322 - 62 + 7$ (b) 7

   (c) -7 (d) $32^2 - 12 + 7$

2. The value of $t^3 - t^2 + t - 1$ for $t = -1$ is

   (a) -4 (b) 0 (c) -2 (d) 1

3. Which of the following does not have $2a$ as a factor ?

   (a) $2a$ (b) $2a^2$ (c) $2a^0$ (d) $2a^3$

4. The G.C.F. of $48ab^2c^3$ and $84a^3b^2c$ is

   (a) abc (b) $12ab^2c$

   (c) $12 \times 4 \times 7a^3b^3c^3$ (d) $48 \times 84a^3b^4c^4$

5. a^2 is the G.C.F. of

   (a) a^2 and a^3b^2 (b) a^2 and a^3b^3

   (c) a^3 and a^3b^2 (d) a^4 and a^3b^2

6. The product of $3x^2y$ and $-2x^2y^2$ is

(a) $6x^4y^3$ (b) x^4y^3

(c) $-6x^4y^3$ (d) $-\frac{2}{3}y$

7. On simplification, $(2x + y)(2x + y) - 4x^2 - y^2$ equals

(a) $4xy$ (b) $2xy$

(c) $8x^2 + 2y^2$ (d) $8x^2 - 2y^2$

8. $(x^3 + y^6)(x^3 - y^6)$ is equal to

(a) $x^9 - y^{36}$ (b) $x^6 + y^{12}$

(c) $x^6 - y^{12}$ (d) $x^9 + y^{36}$

9. $9p^2 - 36pq + 36q^2$ can be expressed as

(a) $3(p + 2q)(p - 2q)$ (b) $9(p + 2q)(p - 2q)$

(c) $3(p - 2q)(p - 2q)$ (d) $9(p - 2q)(p - 2q)$

10. $15xy - 10y^3$ is equal to

(a) $5y(3 - 2y^2)$ (b) $5y(3x - 2y^2)$

(c) $5y(x - 2y^2)$ (d) $5y(3x - y^2)$

11. Fill in the blanks in each of the following so as to make the statement true :

(a) The coefficient of the product of two monomials is equal to the ... of their coefficients.

(b) The variable part in the product of two monomials is equal to the ... of the variable parts in the given monomials.

(c) $(a + b)(a + b) = a^2 + \ldots + b^2$

(d) $(a-b)(a-b) = a^2 \ldots + b^2$

(e) $(a+b)(a-b) = \ldots$

(f) $4a^2 - 4ab + b^2 = (2a-b)(\ldots)$

(g) $49x^2 - 25y^2 = (7x-5y)\ (\ldots)$

(h) To multiply a monomial and a binomial, we multiply each term of the binomial by the monomial and . . .

(i) To multiply two binomials, we multiply each term of one . . . and add the products.

(j) The numbers or algebraic expressions which may be multiplied to form a product, are called . . . of the product.

(k) The greatest common factor of two monomials is the largest monomial which is . . . each of them.

12. In the blanks, write the property which has been used in writing the equality relations given below :

(a) $(2ab)(pq) = (pq)(2ab)$ . . .

(b) $(5a)(gh) = (5ag)(h)$ . . .

(c) $p(q+r+s) = pq + pr + ps$ . . .

(d) $(2x)(yz) = (yz)(2x)$ . . .

(e) $(a+b)(c+d) = ac + ad + bc + bd$ . . .

(f) $(2x)(3y)(4z) = 24xyz$ . . . and . . .

13. In each of the following, state if the statement is true (T) or false (F) :

(a) $a + b$ is a monomial.

(b) The coefficient of x^2 in $6x^2$ is 6.

(c) The coefficient of b in $-5ab$ is $5a$.

(d) The product of $4p$ and $4q$ is $4pq$.

(e) The product of $3x$ and $4x$ is $12x$.

(f) The variable part in the product of $3p^3$ and $2p^2$ is p.

(g) The product of 3ef and p + q contains three terms.

(h) The product of two binomials always contains four terms.

(i) The product of two monomials is a binomial.

(j) The commutative property is not valid for the product of two monomials.

(k) The product of – 6p and 2q is – 12pq.

(l) $(3p - 4y)^2 = 9p^2 + 24py + 16y^2$

14. Given below are some expressions in column A and their factors in column B, but not necessarily in the same order. Match the expressions with their factors :

Column A	*Column B*
(a) $3x^2 - 75$	(i) $(a + b)^2$
(b) $a^2 + 2ab + b^2$	(ii) $(a - b)^2$
(c) $a^2 - 2ab + b^2$	(iii) $(a - b)(a + b)$
(d) $a^2 - b^2$	(iv) $(x + 5)(x - 1)$
(e) $x^2 + 4x - 5$	(v) $3(x + 5)(x - 5)$

15. Find the value of $a^2 + 3a - 5$ for

(a) a = 2 (b) a = –3

(c) $a = \frac{1}{2}$ (d) $a = -\frac{1}{4}$

16. Find the value of $2ab^3 - 3a^2b^2 + 5$ for

(a) a = 1 and b = 4 (b) a = –2 and b = 1

(c) $a = \frac{1}{4}$ and $b = -\frac{1}{2}$ (d) $a = -\frac{1}{2}$ and $b = -\frac{1}{4}$

17. Multiply the monomials :

(a) 3 and 2ab

(b) $3a^2b$ and -6

(c) 2ab and $-3ax$

(d) $-\frac{1}{2}x^2y$ and $-\frac{1}{4}x^3y$

18. Multiply the monomials :

(a) $-ax^2y$, $6y$ and $-3ax$

(b) $-6x^3$, $-\frac{1}{2}$ and $10axy^3$

(c) pqr, $-6p^2q^2r^2$ and $-\frac{1}{4}p^3q^3r^3$

(d) a, $2ab$, $-3a^2bc$ and $-\frac{1}{4}ab^2c^3$

19. Simplify :

(a) $5xyx^2y^26y^3$

(b) $(3abc)(abcd^2) - 7(a^2d^2)(b^2c^2)$

(c) $(p^2q^2)(-6r^2) + 3(pqr)(pqr) + 3p^2(q^2r^2)$

20. Find the product of

(a) -9 and $8a - 7b$

(b) $3rt$ and $5r + 7t$

(c) $\frac{1}{2}xy$ and $\frac{1}{2}xy + 4xyz^2$

(d) abc and $a^2 - b^2$

(e) $a^3 + b^3$ and $2ab$

(f) $x - y^2$ and 70

21. Simplify :

(a) $(x+y)(x-y) + x^2 + y^2$

(b) $(p+q)(p+q) - p^2 - 2pq - q^2$

(c) $(a+b)(a+b) - a^2 - b^2$

(d) $(a + b)(ab + bc) + (b + c)(bc + ca) + (c + a)(ca + ab)$

22. Verify that the product remains the same no matter in which order you multiply the following binomials :

(a) $3a - 5b$ and $-5a + 3b$

(b) $2s + t$ and $7s + rt$

(c) $a^2 + d^2$ and $3pqr - ghk$

23. Use the identity $(a + b)^2 = a^2 + 2ab + b^2$ to write the value of each of the following :

(a) $(3x + 4y)(3x + 4y)$

(b) $(6a + 7)(6a + 7)$

(c) $(5 + 2y)(5 + 2y)$

(d) $(p^2 + q^2)(p^2 + q^2)$

24. Use the identity $(a + b)(a - b) = a^2 - b^2$ to evaluate each of the following:

(a) $(2a - 7b)(2a + 7b)$

(b) $(7 - 8m)(7 + 8m)$

(c) $(x^3 + y^2)(x^3 - y^2)$

(d) $(p^2 - q^2)(q^2 + p^2)$

25. Evaluate each of the following squares :

(a) $(x + 1)^2$

(b) $(2x - 3y)^2$

(c) $\left(y - \frac{1}{y}\right)^2$

26. Find the value of each of the following by using a suitable identity :

(a) 89×111 (b) 199×201

(c) $33^2 - 27^2$ (d) $61^2 - 69^2$

(e) 699^2 (f) 701^2

(g) 9999^2 (h) 1111^2

27. Factorize each of the following :

(a) $5a + 20b$ (b) $-6x + 15y$

(c) $a^2 + 3ab$ (d) $10pq - 15q^3$

(e) $-2x - 4x^2 + 8x^3$ (f) $5p^4q^4 - 4p^3q^3r^3 + 3p^2q^2r^2s^2$

28. Express each of the following as a product of two binomials :

(a) $x^2 + 6x + 9$ (b) $4x^2 + 12x + 9$

(c) $4p^2 + 2qp + \frac{1}{4}q^2$ (d) $36x^4 + 84x^2 + 49$

(e) $p^2 - 6p + 9$ (f) $9p^2 - 24p + 16$

(g) $16p^2 - 24pq + 9q^2$ (h) $25p^4 - 10p^2q^2 + q^4$

(i) $100s^2 - 16t^2$ (j) $625x^2 - 36m^2$

(k) $49z^2 - 121$ (l) $10000 - x^{16}$

29. Find the G.C.F. of

(a) 2abc and 10xy (b) ax^2 and 2ab

(c) 2 keys and 4 risk (d) ash and she

(e) $6x^2yz$ and $15xy^2z$ (f) $-15a^2b^2$ and $105a^3b$

(g) $35a^2bc^2$ and $7ab^2c$ (h) $9m^2n^2p^2$ and $18m^2n^2p^2$

(i) $49p^2q^2r^2$ and $147pqr$

30. Express as a monomial and verify your working by taking $x = 2$:

(a) $(-6x)(3)\left(\frac{1}{2}x^3\right)\left(\frac{1}{2}x^2\right)$

(b) $x(3x^3)\left(\frac{1}{4}x^2\right)(-12x)(-2)$

31. Find the value for $p = -\frac{1}{2}$, $q = \frac{1}{4}$ and $r = 1$:

(a) $(2p)(3q^2)(4r^3) + 7$

(b) $(pqr)(-p^2r^3) + p^2q^2r^2$

(c) $(p^2q)\left(-\frac{1}{2}q^2r\right)(-4r^2p) - 2pqr$

32. Use identity $(a-b)^2 = a^2 - 2ab + b^2$ to evaluate each of the following and verify your result by actual multiplication :

(a) $(2x^3 - 5y)(2x^3 - 5y)$

(b) $(p^3 - q^3)(p^3 - q^3)$

(c) $(-6a - f^2)(-6a - f^2)$

33. Factorize completely :

(a) $px + py + qx + qy$

(b) $2px + py + 2qx + qy$

(c) $3px - py + 3qx - qy$

(d) $a^4 - 16$

(e) $16c^4 - 81d^4$

(f) $81y^4 - 882y^2z^2 + 2401z^4$

34. Find the G.C.F. of each pair of expressions given below :

(a) $3(g + h)$ and $5(g^2 - h^2)$

(b) $51pq(a + b)$ and $34p^2q^3(a^2 - b^2)$

(c) $ax + ay + bx + by$ and $x^2 - y^2$

(d) $25r^2 - 49s^2$ and $25r^2 + 70rs + 49s^2$

(e) $36 - 25x^2$ and $36 - 60x + 25x^2$

(f) $p^2 - q^2$ and $(p - q)(p + q)$

(g) $a^4 - b^4$ and $(a + b)(a^2 + b^2)$

35. An object falling under gravity covers a distance $4.9t^2$ metres in t seconds. How far would an object falling under gravity fall in 8 seconds?

36. The power used in an electric bulb is i^2R watts, where i amperes is the

current and R ohms is the resistance. How many watts would be the power consumption if i = .9 and R = 160 ?

37. c, the speed of light in a vacuum, is 3×10^8 metres per second. The mass of a drop of water is .001 gram. The relation behind the atom bomb is $E = Mc^2$, where E joules is the energy produced and M kilogram is the decrease in mass. Find the energy produced if the decrease in mass is equal to that of a drop of water.

38. Express as the product of two algebraic expressions :

(a) $x^2 + 2x + 1 - 9a^2$

(b) $p^2 - 2pq + q^2 - r^2$

(c) $a^{-4} - b^{-4}$

(d) $9 - a^6 + 2a^3b^3 - b^6$

(e) $x^{16} - y^{16} + x^8 + y^8$

(f) $(p + q)^2 - (a - b)^2 + p + q - a + b$

39. Find the G.C.F. of the following :

(a) xy, yz and zx

(b) .14y, .014xy and .0014yz

(c) $(p + q)$, $(p + q)^2$, $(p + q)(q + r)$ and $(q + r)^2$

(d) $36x^2 + 84xy + 49y^2$ and $36x^2 - 49y^2$

(e) $4x^2 + 20xy + 25y^2 - 16z^2$ and $(2x + 5y - 4z)^2$

2.2 Linear Equations in One Variable

In questions 1 to 7, four alternatives are given for answers, out of which only one is correct. Choose the correct answer :

1. The solution of the equation $ax + b = 0$ is

(a) $\frac{a}{b}$ (b) $-b$ (c) $-\frac{b}{a}$ (d) $\frac{b}{a}$

2. -1 is not a root of the equation

   (a) $x + 1 = 0$

   (b) $x - 1 = 2$

   (c) $2y + 3 = 1$

   (d) $2t + 7 + t = t + 5$

3. If a and b are positive integers, then the root of the equation $ax = b$ has to be always a

   (a) positive integer.

   (b) negative integer.

   (c) positive rational number.

   (d) negative rational number.

4. Which of the following might destroy a given equation ?

   (a) Adding the same number to both sides of the equation.

   (b) Subtracting the same number from both sides of the equation.

   (c) Multiplying both sides of the equation by the same number.

   (d) Dividing both sides of the equation by the same non-zero number.

5. The solution of which of the following equations is neither a fraction nor an integer ?

   (a) $2x + 6 = 0$ (b) $3x - 5 = 0$

   (c) $5x - 8 = x + 4$ (d) $4x + 7 = x + 2$

6. The equation which cannot be solved in integers is

   (a) $5y - 3 = -18$ (b) $3x - 9 = 0$

   (c) $3z + 8 = 3 + z$ (d) $9y + 8 = 4y - 7$

7. If $3(x - 3) = 5(2x + 1)$ and $\frac{y-8}{3} = \frac{y-3}{2}$, then the value of $(2x + 3y)(2x - 3y)$ is

   (a) 425 (b) -425 (c) 160 (d) -160

8. Fill in the blanks in each of the following so as to make the statement true :

(a) An equation is a statement of equality which contains . . . .

(b) Any value of the variable which makes both sides of an equation equal, is known as a . . . or a . . . of the equation.

(c) If $ax + b = 0$ is a linear equation in variable x, then a . . . .

(d) Every linear equation in variable x can be reduced to the form $ax + \ldots = \ldots$.

(e) The root of the equation $2y = 5y - \frac{18}{5}$ is . . . .

9. In each of the following, state if the statement is true (T) or false (F) :

(i) The root of the equation $5x - 3 = 11x - 7$ is $-\frac{2}{3}$.

(ii) $17x + 5 = 10x + 3 + 7x$ has one solution.

(iii) If $0.2y + 9 = 0.3y + 7$, then the value of $y^2 - 8y + 1$ is 321.

10. Solve each of the following equations and also verify your solution :

(a) $2x + \frac{1}{3} = 0$

(b) $\frac{4}{5}x + 7 = 12$

(c) $px + 4 = 7$ (p is a constant)

(d) $\frac{2}{21}x + 8 = x + 6$

(e) $3x - \frac{7}{4} = \frac{5}{8} - 8x$

(f) $\frac{12}{7}(x - 5) = 24 + 8x$

(g) $\frac{y - 8}{3} = \frac{7 - 4y}{7}$

(h) $\frac{7y+2}{5} = \frac{6y-5}{11}$

(i) $1.2y + 5.3 = 7y - 3.7$

(j) $\frac{1}{2}x + 7x - 6 = 7x + \frac{1}{4}$

(k) $\frac{3x}{4} + 4x = \frac{7}{8} + 6x - 6$

(l) $\frac{7}{2}x - \frac{5}{2}x = \frac{20x}{3} + 10$

(m) $-11x + \left(\frac{2}{3}x + 3\right) = 5 - 2\left(\frac{x}{3} + 1\right)$

11. Find the dimensions of a rectangle if its perimeter is 100 cm and its length is 20 cm more than its breadth.

12. A toy costs $\frac{1}{4}$th of its price and 48 rupees more, Find the cost of this toy.

13. One number is five times another. Their sum is 90. What are these two numbers ?

14. A number is multiplied by 15 and then added to 50. The result is 155. Find the number.

15. The length of a rectangle is three times its width. If the perimeter is 84 m, then find the length of the rectangle.

16. In a certain examination, a total of 3768 students secured first division in the years 1986 and 1987. The number of the first divisions in 1987 exceeded those in 1986 by 34. How many students got first division in 1986?

17. Radha got Rs 1748 as her monthly salary and over-time. Her salary exceeds the over-time by Rs 1200. What is her monthly salary ?

18. A child had a certain number of peanuts. He gave two-thirds of these to the squirrels and one-fourth of the remaining ones to the crows. He was then left with 12 peanuts. How many did he have in the beginning?

What would be wrong with the problem if the child were left with ten peanuts in the end instead of 12 ?

19. The ancient Hindu mathematicians wrote their books entirely in verse. Even the subject-matter used to have a touch of fancy. A typical problem in the solution of equations would be something like this :

"Half the flowers in this garland are jasmines, one-fourth of the total being roses. The remaining seventeen are as lovely as your face. Tell me quickly, O'pretty maiden ! the number of flowers in this garland." Solve the above problem.

20. My age is four times the difference of my age after four years and my age three years back. How old am I ?

21. Three villagers met under a tree on an afternoon. One of them had 250 g of *sattu* (barley, first baked and then ground) whereas another one had 350g of the same. The third offered to pay for his share of *sattu*. They distributed the total amount equally amongst them and the third villager paid paise forty for his share. How should the first two divide this amount between them ?

22. One jar has the same amount of water in it as another one has oil. 30ml of oil is transferred from the jar containing oil into the jar containing water. Now one-sixth of the mixture in the jar which originally contained water, is transferred to the jar which originally held oil. If both the jars now have the same amount of liquid, then how many ml of liquid did each jar contain in the beginning ?

23. Cheetu had a quarrel with her younger sister. To make up with her, he played the following trick. He asked her to perform the following sequence of operations :

1. "Choose *any* number without telling me what it is.
2. Add three to your number.
3. Multiply the result by two.
4. Add three to the product.
5. Add the original number.
6. Divide by three.
7. Subtract the original number."

Declaring himself a magician, Cheetu told her sister that she was left with the number three. Can you show that no matter with what number the little girl started, she would have ended up with three only ?

24. Now consider how Cheetu solves the equation $\frac{2x+1}{5}+\frac{x-3}{2}=\frac{7}{11}$.

$$\frac{2x+1}{5}+\frac{x-3}{2}=\frac{7}{11}$$

or, $$\frac{(2x+1)+(x-3)}{5+2}=\frac{7}{11}$$

or, $$\frac{3x-2}{7}=\frac{7}{11}$$

or, $$11(3x-2)=7^2$$

or, $$33x=49+22$$

or, $$x=\frac{71}{33}$$

Find out whether Cheetu's solution is correct. What is wrong with his working ?

25. Ram is twice as old as Shyam was when Ram was as old as Shyam is now. Ram is 24 now. How old is Shyam now ?

26. There are 90 multiple choice questions in a test. [A multiple choice question is one for which some choices (a), (b), etc. are given and you have to select the correct one.] Suppose you get two marks for every correct answer and for every question you leave unattempted or answer wrongly, one mark is deducted from your total score of correct answers. If you get a zero in the test, then how many questions did you answer correctly ?

UNIT THREE

Commercial Mathematics

3.1 Direct and Inverse Variations

In questions 1 to 7, four alternatives are given for answers, out of which only one is correct. Choose the correct answer :

1. u and v vary directly with each other. When u is 10, v is 15. Which of the following is not a possible pair of corresponding values of u and v?

(a) 2 and 3 (b) 8 and 12

(c) 15 and 20 (d) 25 and 37.5

2. x and y vary inversely with each other. When x is 10, y is 6. Which of the following is not a possible pair of corresponding values of x and y?

(a) 12 and 5 (b) 15 and 4

(c) 25 and 2.4 (d) 45 and 1.3

3. Assuming land to be uniformly fertile, the area of land and the yield on it vary

(a) directly with each other.

(b) inversely with each other.

(c) neither directly nor inversely with each other.

(d) sometimes directly and sometimes inversely with each other.

4. The number of teeth and the age of a person vary

(a) directly with each other.

(b) inversely with each other.

(c) neither directly nor inversely with each other.

(d) sometimes directly and sometimes inversely with each other.

5. If 20 persons can build a wall 100 m long in 28 days, then the time required by 16 persons to build a similar wall 120 m long is

(a) $26\frac{22}{55}$ days (b) 42 days

(c) $29\frac{1}{6}$ days (d) 48 days

6. By travelling at a speed of 48 kilometres per hour, a car can finish a certain journey in 10 hours. To cover the same distance in 8 hours, the speed of the car should be

(a) 60 km/h (b) 80 km/h

(c) 30 km/h (d) 40 km/h

7. A truck needs 54 litres of diesel for covering a distance of 297 km. The diesel required by the truck to cover a distance of 550 km is

(a) 100 litres (b) 50 litres

(c) 25.16 litres (d) 25 litres

8. Fill in the blanks in each of the following so as to make the statement true:

(a) Two quantities are said to vary . . . with each other if they increase (decrease) together in such a manner that the ratio of their corresponding values remains constant.

(b) x and y are said to vary inversely with each other if for some positive number k, . . . = k.

(c) x and y are said to vary directly with each other if for some positive number k, . . . = k.

(d) Two quantities are said to vary . . . with each other if an increase in one causes a decrease in the other in such a manner that the product of their corresponding values remains constant.

(e) When equal distances are covered in equal intervals of time, the speed is said to be . . . .

(f) An average speed of x km/h means that constant speed at which a distance of x km would be covered in . . . .

(g) Time, distance and speed are connected by the formula

. . . × . . . = . . .

(h) 36 km/h = . . . m/s.

(i) If u = 3v, then u and v vary . . . with each other.

(j) If uv = 3, then u and v vary . . . with each other.

(k) If 12 pumps can empty a reservoir in 20 hours, then time required by 45 such pumps to empty the same reservoir is . . . hours.

9. Modify each of the following statements so that it becomes a true statement :

(a) Two quantities x and y are said to vary directly with each other if for some rational number k, xy = k.

(b) When equal distances are covered in equal intervals of time, the speed is said to be average.

(c) An average speed of x km/h means that constant speed at which a distance of x km will be covered in h hours.

(d) Time, distance and speed are connected by the formula

Speed = Distance × Time

(e) 36 km/h = 8 m/s.

(f) Time that a train takes in crossing a bridge is the time which it takes in covering a distance equal to the length of the bridge.

(g) When the distance is kept fixed, speed and time vary directly with each other.

(h) When the speed is kept fixed, time and distance vary inversely with each other.

10. In each of the following, state if the statement is true (T) or false (F) :

(i) If a tree 24 m high cast a shadow of 15 m, then the height of a pole that casts a shadow of 6 m under similar conditions is 9.6 m.

(ii) If d varies directly as t^2, then we can write $d\,t^2 = k$, where k is some constant.

(iii) Time that a train takes in crossing a pole is the time which the train takes in covering a distance equal to the length of the train.

11. Determine the quantities which vary directly with each other :

(a)

x	0	.5	2	8	32
y	0	2	8	32	128

(b)

p	1^2	2^2	3^2	4^2	5^2
q	1^3	2^3	3^3	4^3	5^3

(c)

r	2	5	10	25	50
s	25	10	5	2	0

(d)

u	2	4	6	9	12
v	18	9	6	4	3

12. Which quantities in the previous problem vary inversely with each other ?

(a) x and y

(b) p and q

(c) r and s

(d) u and v

13. Salama types 540 words during half an hour. How many words would she type in 6 minutes ?

14. 68 boxes of a certain commodity require a shelf-length of 13.6 m . How many boxes of the same commodity would occupy a shelf-length of 20.4 m ?

15. A private taxi charges a fare of Rs 260 for a journey of 200 km. How much would it travel for Rs 279.50 ?

16. If the thickness of 500 sheets of paper is 3.5cm, then what would be the thickness of 275 sheets of this paper ?

17. If the cost of 93m of a certain kind of plastic sheet is Rs 1395, then what would it cost to buy 105m of such plastic sheet ?

18. The weight of a normal person in kilograms is roughly 14 times the amount of blood in his body in litres. What would be the weight of a person if his body carries 38.501 litres of blood ?

19. If 8 labourers, digging 8 hours a day, can dig a pond in 8 days, then how many days will 3 labourers, digging 3 hours a day, take in digging this pond ?

20. A car is travelling at the average speed of 50 km/h. How much distance would it travel in 12 minutes ?

21. How much time would a cyclist moving at the average speed of 6 km/h take in covering a distance of 19.5 km ?

22. A bullock-cart covers a distance of 18 km in four hours and a half. What is the average speed of the cart ?

23. Jayanti Janta Express Train covers a distance of 180 km in 4 hrs. Find

its average speed. Also find how much time will it take in covering a distance of 325 km ?

24. Sound travels at the speed of 340 m/s. If a gun is heard after seven and a half second of its being fired, then how far had it been fired ?

25. Seeta can polish a table in 12 hours. Shareefan can polish this table in 8 hours. In how many hours would they be able to polish it together ?

26. A 500m long train crosses a pole in 15 seconds. At one station some of the carriages are removed. Near the next station it crosses a pole in 12 seconds. What is the length of the train now ?

27. How much time will a train, 171m long, take to cross a bridge, 229m long, if it is running at a speed of 45 km/h ?

[*Hint* : In order to cross the bridge, the train will cover a distance of (171 + 229)m.]

28. A train, 273m long, is running at 60 km/h. How much time will it take to cross a platform 177m long ?

29. A train, 77m long, is running at 60 km/h. If it takes 30 seconds to cross a bridge, then find the length of the bridge.

30. Length of the railway platform of a small town is 150m. A passenger sitting in a mail train noted that it crossed the platform in just 5 seconds. Find the speed of the train. Were the train 250m long, how much time will the train take in crossing the platform ?

31. A and B can do a piece of work in 10 days, B and C can do the same work in 15 days while C and A can do it in 20 days. In how many days can B alone do the same work ?

32. A 225m long train crosses a 275m long tunnel in one minute. Find the speed of the train in km/h.

33. Mr. Gupta in his morning walk crosses a bridge in 7.5 minutes. His average speed is 2 km/h. Find the length of the bridge. Mr. Gupta's grandson walks the bridge in 4 minutes. How much time would the grandson take in covering a distance of one km ?

34. If a student cycles to school at the speed of 4 km/h, then he gets late by 15 minutes. If he cycles at the speed of 6 km/h, then he is 5 minutes

early. What is the distance to school ? What should be his speed if he wants to reach the school just in time ?

35. Delhi and Roorkee are 180 km apart by road. A car starts from Delhi towards Roorkee at 7.00 A.M. at the speed of 55 km/h. Another car starts from Roorkee towards Delhi at the same time but travels at the speed of 45 km/h. At what time and how far from Roorkee will the two cars meet?

[*Hint :* The distance between the two cars is decreasing at the rate of (55+45) km/h.]

36. In a one kilometre race, Raju beats Sanju by 400m and Debu by 200m. By how much would Debu beat Sanju in the same race ?

3.2 Percentage and Some Applications

In questions 1 to 6, four alternatives are given for answers, out of which only one is correct. Choose the correct answer :

1. If 90 % of x is 315km, then the value of x is

(a) 325km (b) 350km

(c) 405km (d) 340km

2. On selling an article for Rs 329, a dealer lost 6%. The cost price (C.P.) of the article is

(a) Rs 310.37 (b) Rs 348.74

(c) Rs 335 (d) Rs 350

3. The time in which a sum of Rs 4000 will yield a simple interest of Rs1200 is

(a) 2 years (b) $2\frac{1}{2}$ years

(c) 3 years (d) 5 years

4. The sum which will earn simple interest of Rs 126 in 2 years at 14% per annum is

(a) Rs 394 (b) Rs 395

(c) Rs 450 (d) Rs 540

5. Selling price of 9 articles is equal to the cost price of 15 articles. In the transaction there is

(a) loss of $66\frac{2}{3}\%$

(b) loss of 40 %

(c) gain of $66\frac{2}{3}\%$

(d) gain of 40 %

6. To gain 25% after allowing a discount of 10%, the shopkeeper must mark the price of the article which cost him Rs 360 as

(a) Rs 500 (b) Rs 450

(c) Rs 460 (d) Rs 486

7. Fill in the blanks in each of the following so as to make the statement true :

(a) In case of gain, $\text{S.P.} = \frac{(100 + \ldots\ \%) \times \text{C.P.}}{100}$

and $\text{C.P.} = \frac{100 \times \text{S.P.}}{\ldots + \text{gain}\%}$

(b) In case of loss, $\text{S.P.} = \frac{(100 - \ldots\ \%) \times \text{C.P.}}{\ldots}$

and $\text{C.P.} = \frac{\ldots}{100 - \text{loss}\%}$

(c) When discount is offered in cash, it is generally expressed as a percentage of ... price.

(d) Simple interest $= \frac{\text{P} \times \text{T} \times \text{R}}{100}$, where T is ..., R % is ... and P is ... .

(e) The difference of simple interest for 2 years and 3 years on a sum of Rs 2100 at 8% per annum is . . . .

8. In each of the following, state if the statement is true (T) or false (F) :

(i) In case of loss, $\text{C.P.} = \frac{100 \times \text{S.P.}}{100 + \text{loss}\%}$

(ii) In case of gain, $\text{S.P.} = \frac{(100 + \text{gain }\%) \times \text{C.P.}}{100}$

(iii) The interest on Rs 350 at 5% per annum for 73 days is Rs 35.

(iv) The simple interest on a sum of Rs P for T years at R% per annum is given by the formula

$$\text{Simple Interest} = \frac{P \times T \times R}{100}$$

(v) C.P. = M.P. – Discount.

9. Sudha obtained 504 marks in a certain examination. If she obtained 63% of the total marks, then find the total marks.

10. Kishan spends 30% of his salary on food and donates 3% of his salary in a temple. In a particular month, he spent Rs 231 on these two items. What is his total salary for this month ?

11. Reshu got 99% marks in Mathematics, 76% marks in Hindi, 61% in English, 84% in Science and 95% in Social Studies. If each subject carries 100 marks, then find the percentage of marks obtained by Reshu in the aggregate of all the subjects.

12. An alloy of tin and copper consists of 24 parts of tin and 136 parts of copper. Find the percentage of copper in the alloy.

13. What is the C.P. of a chair which when sold at Rs 286 brings a profit of 30% ?

14. A shopkeeper purchased a TV for Rs 2000 and a radio for Rs 750. He

sells the TV at a profit of 20% and the radio at a loss of 5%. What is his total loss or gain ?

15. What sum of money lent out at 16% per annum simple interest would produce Rs 160 as interest in 2 years ?

16. In how much time will the simple interest on a certain sum be Rs 168 if it produces Rs 21 as interest in 4 months at half the rate ?

17. Find the number a if

(a) 1% of a is 5.

(b) 12% of a is 18.

(c) 40% of a is 384.

(d) 100% of a is 100.

18. Rasheed deposits 12% of his income in a bank. He deposited Rs 1440 in the bank during 1987. What was his total income for the year 1987?

19. Radha earns 22% of her investment. If she earns Rs 187, then how much did she invest ?

20. Find the S.P. if

(a) M.P. = Rs 650 and discount = 2.5%

(b) M.P. = Rs 1300 and discount = 1.5%

(c) M.P. = Rs 5450 and discount = 5%

21. Find the M.P. if

(a) S.P. = Rs 3430 and discount = 2%

(b) S.P. = Rs 495 and discount = 1%

(c) S.P. = Rs 9250 and discount = $7\frac{1}{2}\%$

22. Find discount in per cent when

(a) M.P. = Rs 625 and S.P. = Rs 562.50

(b) M.P. = Rs 1600 and S.P. = Rs 1180

(c) M.P. = Rs 900 and S.P. = Rs 873

23. Find simple interest when

(a) Principal = Rs 800, rate = 6% per annum and time = 4 years.

(b) Principal = Rs 450, rate = 12% per annum and time = 3 years.

(c) Principal = Rs 600, rate = 2% per month and time = 20 months. Also, find the amount in each case.

24. Find principal when

(a) Simple interest = Rs 36, rate = 3% per annum and time = 3 years.

(b) Simple interest = Rs 140, rate = 16% per annum and time = $2\frac{1}{2}$ years.

(c) Simple interest = Rs 72, rate = 3% per month and time = 3 months.

25. Find time when

(a) Principal = Rs 1000, rate = 8% per annum and simple interest = Rs 200.

(b) Principal = Rs 640, rate = $12\frac{1}{2}$% per annum and simple interest = Rs 40.

(c) Principal = Rs 10000, rate = 18% per annum and simple interest = Rs 12600.

26. Find rate when

(a) Principal = Rs 500, simple interest = Rs 150 and time = 4 years.

(b) Principal = Rs 400, simple interest = Rs 78 and time = $1\frac{1}{2}$ years.

(c) Principal = Rs 700, simple interest = Rs 168 and time = 16 months.

27. At what rate per cent per annum will Rs 1100 produce Rs 550 as interest in 5 years ?

28. A shopkeeper offers 2.5% discount on cash purchases. What cash amount would John pay for a cycle the marked price of which is Rs 650?

29. What will be the marked price of an aticle if it is sold for Rs 152 after allowing a 5% discount ?

30. As per rules valid in the year 1989-90, no income tax is levied on first 18000 rupees of one's annual income. On the next 7000 rupees, income tax is charged at the rate of 20% of the remaining amount. Rekha's annual income for the year 1989-90 is Rs 24856. Calculate the income tax payable by her for that year.

31. The marked price of an article is Rs 500. The shopkeeper gives a discount of 5% and still makes a profit of 25%. Find the cost price of the article.

32. A person gained 20% by selling an article for Rs 240. At what price must he sell it to gain 10%.

33. Kriplani sold his old dining table and chairs to Mathai for Rs 950. If by doing so he suffered a loss of 24%, for how much had he puchased the table and the chairs ?

34. Harish bought a cradle for Rs 215 and later sold it to Ram at a profit of 5%. Ram used it for his son for a period of two years and later sold it to his servant at a loss of 20%. For how much did the servant get it?

35. A shopkeeper buys pens at the rate of Rs 75 per 100. For how much should he sell each pen so as to make a gain of 15%?

36. Rajneesh purchased 40 dozens oranges at Rs 8 a dozen. He was able to sell half of these at Re.1 per orange. By now 20 oranges had rotten. He sells the remaining oranges at the rate of 75 paise each. Find his loss or gain.

37. If by selling a *dupatta* for Rs 17.50, a cloth merchant suffers a loss of $12\frac{1}{2}$ %, then what price of the *dupatta* would bring him a profit of 20%?

38. By selling a bucket for Rs 24, a blacksmith loses 20% of his cost. If he sells it for Rs 27, what profit or loss would be there for him ?

39. A shopkeeper marks his goods in such a way that after allowing a 25% discount on the marked price, he still makes a profit of 50%. Find the ratio of the C.P. to the M.P.

40. A dealer buys an article for Rs 380. At what price must he mark it so that after allowing a discount of 5%, he still makes a profit of 25% ?

41. Articles are marked at a price which gives a profit of 25%. After allowing a certain discount, the profit reduces to $12\frac{1}{2}$ %. Find the discount per cent.

42. A shopkeeper marks his goods at 40% above the cost price but allows a discount of 5% for cash payment to his customers. What actual profit does he make, if he receives Rs 1064 after paying the discount?

43. In a debate competition, the judges decide that 20% of the total marks would be given for accent and presentation. 60% of the rest are reserved for the subject matter and the rest are for rebuttal. If this means 8 marks for rebuttal, then find the total marks.

44. A dealer bought 10 sewing machines of a particular type for Rs 8000 and sold them at a profit equal to the selling price of three machines. Find the selling price of one sewing machine.

45. The cost price of 20 mangoes is equal to the selling price of 15 mangoes. Is there gain or loss? Find the gain (or loss) per cent.

46. Usha bought 100 eggs for Rs 80. She sold half of these at a profit of 10%. Five eggs got broken. At what profit per cent should she sell the remaining eggs so as to gain $12\frac{1}{2}$ % on the whole, assuming that she found a one-rupee coin on the way and is going to count it in her profit? Had she not found the coin, and had she sold the remaining eggs cost-to-cost, what profit or loss % would she have made ?

47. Find the simple interest on Rs 2250 for $2\frac{1}{2}$ years at the same rate on which Rs 5250 amounts to Rs 5932.50 in $3\frac{1}{2}$ years.

48. Neeraj borrowed Rs 1500 on 27 March 1965 from a friend at the rate of 4% per annum simple interest. If he clears the loan on June 8 1966, how much interest will he have to pay?

49. Jeewan deposited Rs 2500 in his bank for buying Magnum certificates issued by the State Bank of India. Unfortunately, his application for the certificates was rejected. However his money was refunded on March 27 1988. He was paid interest on his money at the rate of 8% per annum for the period starting from January 15 1988. How much money did he get back in all ?

50. One can borrow money from a bank for setting up a dairy or a poultry farm. Vijay set up a poultry farm and had to invest Rs 8888 for this purpose. Under the rules for loan, the bank loans at the most 75% of the total investment and the person concerned has to invest the remaining 25% of the total investment. The rate of simple interest is $12\frac{1}{2}$ % per annum. Vijay borrowed as much money from the bank as he could under the rules. After $1\frac{1}{2}$ years, he cleared the loan. How much money did he return to the bank?

51. A manufacturer of knives sold a certain number of knives to the wholesale dealer at a profit of 25%. The wholesale dealer sold the same to a retailer at a profit of 25% again. The retailer had to raise some money quickly for an emergency and so he sold the knives to a fellow shopkeeper at a loss of 25% and obtained a sum of Rs 11718.75. Find the cost of these knives for the manufacturer.

52. As a publicity stunt, Devakee sold 10 pens at a loss of 5%. Next day she raised the S.P. by 25% and sold 100 pens. To her dismay, she found that she had gained only Rs 25 on these pens. Find the C.P. of these 100 pens.

53. Divide Rs 4350 in two parts so that the simple interest on the first when deposited for one year at 9% per annum and that on the second when deposited for two years at 10% per annum in a bank are the same.

54. A sum of money lent out at simple interest amounts to Rs 600 in two years and Rs 800 in six years. Find the sum and the rate of interest.

55. By reducing the selling price of an article by Rs 50, a gain of 5% turns into a loss of 5%. Find the original selling price of the article.

56. Rahim gets as his share 5% of the total profits earned by a certain company in which he is a sleeping partner. What were the total profits of the company if his share of profits is Rs 5000?

57. Gunpowder contains 75% nitre and 10% sulphur. Find the amount of gunpowder which carries 9 kg nitre. What amount of gunpowder would contain 2.3 kg sulphur ?

58. A nursery has 5000 plants. 5% of the plants are of roses and 1% are mango plants. What is the total number of other plants ?

59. A shopkeeper offers 5% discount on all his goods to all his customers. He offers a further 2% discount on the reduced price to those customers who pay cash. What will you actually have to pay for an article in cash if its M.P. is Rs 4800 ?

UNIT FOUR

Geometry

4.1 Triangle

In questions 1 to 6, four alternatives are given for the answers, out of which only one is correct. Choose the correct answer :

1. If all the three angles of a triangle are equal, then each of them is equal to

(a) 90^o (b) 45^o (c) 60^o (d) 30^o

2. If the two acute angles of a right triangle are equal, then each acute angle is equal to

(a) 30^o (b) 45^o (c) 60^o (d) 90^o

3. An exterior angle of a triangle is equal to 105^o and two interior opposite angles are equal. Each of these angles is equal to

(a) 75^o (b) $72\frac{1^o}{2}$ (c) $52\frac{1^o}{2}$ (d) $37\frac{1^o}{2}$

4. If two sides of a triangle are of lengths 6 cm and 4 cm, then the third side must be

(a) >10 cm (b) < 10 cm (c) $= 10$ cm (d) ≤ 10 cm

5. If one angle of a triangle is equal to the sum of the other two angles, then the triangle is

(a) an isosceles triangle (b) an obtuse triangle

(c) an equilateral triangle (d) a right triangle

6. Side BC of a triangle ABC has been produced to a point D such that $\angle ACD = 120^\circ$. If $\angle B = \frac{1}{2}\angle A$, then $\angle A$ is equal to

(a) 80° (b) 75° (c) 60° (d) 90°

7. In each of the following, fill in the blanks so as to make the statement true:

(a) An acute triangle is a triangle with ... acute angle (s).

(b) An isosceles triangle is a triangle with ... equal sides.

(c) An obtuse triangle is a triangle with ... obtuse angle (s).

(d) An equilateral triangle is a triangle with ... equal sides.

(e) A scalene triangle is a triangle with ... sides equal.

8. Complete each of the following, so as to make it true :

(a) It is impossible to have a triangle with two obtuse angles because ... .

(b) It is impossible to have a triangle with angles 60°, 50° and 45°, because ... .

(c) It is impossible to have a triangle with sides of length 4 cm, 7 cm, and 2 cm, because ... .

(d) It is impossible to have an exterior angle of a triangle equal to an interior opposite angle, because ... .

(e) It is impossible to have two distinct perpendicular segments to a line, from a point outside it, because ... .

9. In each of the following, state if the statement is true (T) or false (F):

(i) A triangle has three sides.

(ii) Any three line-segments make up a triangle.

(iii) The sum of any two sides of a triangle is greater than the third side.

(iv) The sum of any two angles of a triangle is greater than the third angle.

(v) The vertices of a triangle are three collinear points.

(vi) An equilateral triangle is isosceles also.

(vii) Every right triangle is scalene.

(viii) Each acute triangle is equilateral.

(ix) No isosceles triangle is obtuse.

(x) If a triangle has one right angle, it also has another right angle.

10. The angles of a triangle are in the ratio 3 : 4 : 5. Find the smallest angle.

11. One of the angles of a triangle has measure 80° and the other two angles are equal. Find these two angles.

12. Two acute angles of a triangle are equal. Find the two angles.

13. ABC is a triangle in which $\angle B = \angle C$ and ray AX bisects the exterior angle DAC. If $\angle DAX = 70^\circ$, find $\angle ACB$.

14. In a triangle, an exterior angle at a vertex is 95° and its one of the interior opposite angles is 55°. Find all the angles of the triangle.

15. One angle of a triangle is greater than the sum of the other two. What can you say about the measure of this angle ? What type of a triangle is this?

16. The sides of a triangle are produced in order. Find the sum of the three exterior angles so formed.

17. In ΔABC, $\angle A = 100^\circ$, AD bisects $\angle A$ and $AD \perp BC$. Find $\angle B$.

18. In ΔABC, $\angle A = 50^\circ$, $\angle B = 70^\circ$ and bisector of $\angle C$ meets AB in D. Find the angles of the triangles ADC and BDC.

19. A student was asked to construct a triangle with sides 3.2 cm, 3.2 cm and 6.8 cm. The student could not succeed. Can you explain, why he could not ?

20. A student when asked to measure two exterior angles of ΔABC observed that the exterior angle at $A = 103^\circ$ and that at $B = 74^\circ$. Is this possible? Why or why not ?

21. An exterior angle of a triangle is 108° and its interior opposite angles are in the ratio 4 : 5. Find the angles of the triangle.

22. In Fig. 4.1, AD and CF are respectively perpendiculars to sides BC and AB of ΔABC. If $\angle FCD = 50^{\circ}$, find $\angle BAD$.

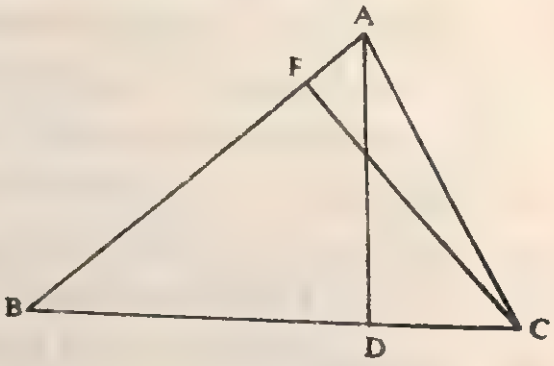


Fig. 4.1

23. In ΔABC, BC = a, CA = b and AB = c.

(a) State the three triangle inequality relations

(b) Show that

(i) $a - b < c$ and $b - a < c$

(ii) $c - a < b$ and $a - c < b$

(iii) $b - c < a$ and $c - b < a$

24. In ΔABC, $\angle A = 60^{\circ}$, $\angle B = 80^{\circ}$ and the bisectors of $\angle B$ and $\angle C$ meet at O. Find

(i) $\angle C$

(ii) $\angle BOC$

25. The bisectors of the acute angles of a right triangle meet at O. Find the angle at O between the two bisectors.

26. In Fig. 4.2, ABC is a right triangle right angled at A. D lies on BA produced and DE⊥BC, intersecting AC at F. If $\angle AFE = 130^{\circ}$, find

(i) $\angle BDE$

(ii) $\angle BCA$

(iii) $\angle ABC$

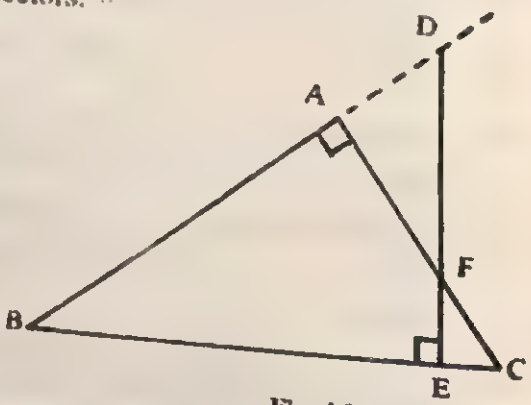


Fig. 4.2

27. Line-segments AB and CD intersect at O such that AC ∥ DB. If $\angle CAB = 35^{\circ}$ and $\angle CDB = 55^{\circ}$, find $\angle BOD$.

28. In Fig. 4.3, ΔABC is right angled at A. Q and R are points on line BC and P is a point such that $QP \parallel AC$ and $RP \parallel AB$. Find $\angle P$.

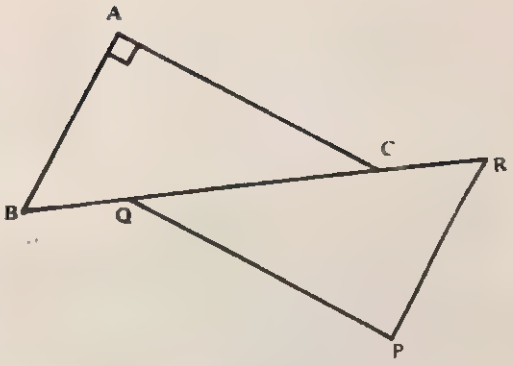


Fig. 4.3

29. In ΔABC, $\angle B = 60^\circ$, $\angle C = 40^\circ$, $AL \perp BC$ and AD bisects $\angle A$ such that L and D lie on side BC. Find $\angle LAD$.

30. A transversal t intersects two lines l and m in points P and Q respectively. The bisectors of a pair of interior angles on the same side of the transversal meet at R at right angles.

(i) What can you say about the sum of the two interior angles on the same side of the transversal ?

(ii) Is $l \parallel m$? Why or why not ?

31. The bisectors of exterior angles at B and C of ΔABC meet at O. If $\angle A = x^\circ$, find $\angle BOC$ in terms of x.

32. In ΔABC, $\angle A = 50^\circ$ and BC is produced to a point D. The bisectors of $\angle ABC$ and $\angle ACD$ meet at E. Find $\angle E$.

32. The side BC of ΔABC is produced to a point D. The bisector of $\angle A$ meets side BC in L. If $\angle ABC = 30^\circ$ and $\angle ACD = 115^\circ$, find $\angle ALC$.

33. In ΔABC, $\angle B$ and $\angle C$ are each acute and $AL \perp BC$ such that L lies on side BC. Explain, why each of the following statements is true :

(a) $AL > \frac{1}{2}(AB + AC - BC)$

(b) $AL < \frac{1}{2}(AB + AC + BC)$

34. In Fig. 4.4, measures of some angles are indicated. Find the value of x.

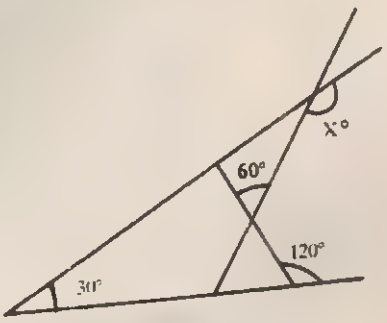


Fig. 4.4

35. D is a point on the side BC of ΔABC. A line PDQ, through D, meets side AC in P and AB

produced at Q. If $\angle A = 80^\circ$, $\angle ABC = 60^\circ$ and $\angle PDC = 15^\circ$, find

(i) $\angle AQD$ (ii) $\angle APD$

4.2 Circle

In questions 1 to 5, four alternatives are given for answers, out of which only one is correct, choose the correct answer :

1. P and Q are two points on a circle with centre O and a point X of the circle lies in the exterior of $\angle POQ$. The part P X Q of the circle is a
   (a) semi-circle (b) minor arc
   (c) major arc (d) segment of the circle

2. All diameters of a circle are
   (a) collinear (b) concurrent
   (c) perpendicular (d) parallel

3. The total number of diameters of a circle is
   (a) one (b) two
   (c) four (d) none of these

4. O is the centre of a circle with diameter 10 cm. If P is a point such that OP = 10 cm, then P lies
   (a) on the circle
   (b) in the interior of the circle
   (c) in the exterior of the circle
   (d) both in the interior and exterior of the circle

5. C and D are two points on a circle with centre O such that C,O and D are not collinear. The line-segment CD is
   (a) a chord of the circle
   (b) a diameter of the circle
   (c) an arc of the circle
   (d) a segment of the circle

6. Fill in the blanks, in each of the following, so as to make the statement true :
   (a) Every point on a circle is ... from its centre.
   (b) The distance of a point on the circle from the centre of the

circle is called the ... of the circle.

(c) The line-segment joining a point on the circle to its centre is called a ... of the circle.

(d) All radii of a circle are ....

(e) Concentric circles are circles having ....

(f) A chord of a circle is a line-segment with end-points ....

(g) A diameter of a circle is a chord of the circle that ....

(h) All diameters of a circle are ....

(i) A diameter is the longest ....

(j) A diameter of a circle is twice ....

(k) A circle together with its interior is called ....

(l) A chord of a circle contains exactly ... points of the circle.

(m) The centre of a circle ... a point of the circle.

(n) The semi-circle determined by diameter AB of a circle does not contain ....

7. In each of the following, state if the statement is true (T) or false (F):

(i) Every circle has a centre.

(ii) The centre of a circle is a point of the circle.

(iii) Any two radii of a circle make up a diameter.

(iv) Every chord of a circle is parallel to some diameter of the circle.

(v) A circle is symmetric about each of its diameters.

8. Draw a circle of radius 3 cm. Also draw

(i) a radius,

(ii) a diameter and

(iii) a chord of this circle and name them.

9. With line-segment AB as diameter, draw a semi-circle.

10. Draw a line-segment PQ. With centre P and radius PQ, draw a circle. Draw the diameter QR and shade one of the semi-circular regions.

11. Draw a circle with centre O and radius 3 cm. Draw two diameters AB and CD such that $AB \perp CD$. Join and measure each of the line-segments AC, CB, AD and DB.

12. Draw two circles with centre O and radii 2 cm and 3 cm respectively. Shade the part of the plane between two circles.

13. Draw a circle with centre O and radius 4 cm and draw its diameter AB. Now draw two circles with diameters AO and OB.

14. In Fig. 4.5, O is the centre of the circle. State if the following line-segments is a chord, a radius or a diameter:

(i) AB (ii) BC (iii) AO
(iv) BD (v) AC (vi) OE

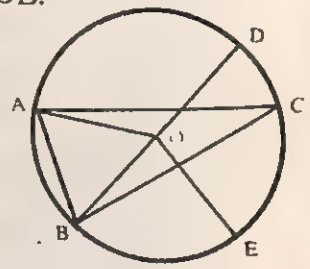


Fig. 4.5

15. Take a line-segment PQ. With centres P and Q and radius PQ in either case, draw two circles intersecting at C and D. Join CD intersecting PQ at M. Measure

(i) PM (ii) MQ (iii) $\angle$CMQ

16. In Fig. 4.6, O is the centre of the circle. Name all the minor arcs of the circles with any two points from A, C, F, B, D and E as their end-points.

17. Take any two points P and Q. With centre P, draw two circles C_1 and C_2 such that Q lies in the interior of C_2 and in the exterior of C_1.

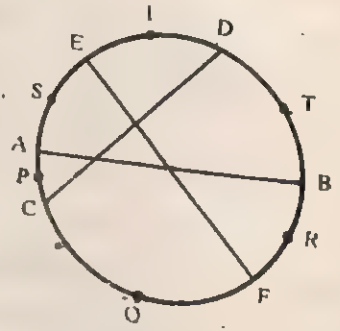


Fig. 4.6

18. Given a circle with centre O and radius 2.5 cm, what is the length of the longest chord of the circle ?

19. Draw any circle and take any three points A, B and C on it. Join AB, BC and CA. What relations exist between AB, BC and CA ? Now, state if three collinear points can lie on a circle.

20. In a circle with centre O, AB is a chord that does not pass through O. Is it true to say that length of AB is less than the length of any diameter of the circle ? Why or why not ?

21. Draw a circle C and shade the circular region D. Also, draw a line l to intersect the circle in two points A and B. Name the figure which is common to l and D.

4.3 Geometrical Constructions

In questions 1 and 2, four alternatives are given for answers, out of which only one is correct. Choose the correct answer :

1. A triangle can be constructed by taking its sides as

(a) 1.8cm, 2.6cm, 4.4cm (b) 2cm, 3cm, 4cm

(c) 2.4cm, 2.4cm, 6.4cm (d) 3.2cm, 2.3cm, 5.5cm

2. A triangle can be constructed by taking its two angles as

(a) 80^o, 60^o (b) 75^o, 115^o

(c) 135^o, 45^o (d) 90^o, 90^o

3. Fill in the blanks in each of the following so as to make the statement true :

(a) A point M is called the mid-point of a line-segment AB, if . . . .

(b) A line EF is said to bisect a line-segment AB, if . . . .

(c) The ray AX is said to be the bisector of $\angle$ BAC, if . . . .

(d) Two lines are perpendicular, if they intersect and . . . .

(e) A line l is said to be the perpendicular bisector of a line-segment AB if l intersect AB at . . . and l is . . . AB.

(f) Two angles are said to be equal if . . . .

(g) In a right triangle, the side opposite the right angle is called its . . . .

4. In each of the following, state if the statement is true (T) or false (F) :

(i) Two circles with distinct centres always intersect.

(ii) A line and a circle in a plane never intersect.

(iii) There is one and only one perpendicular to a line from a point outside it.

(iv) We can draw exactly one triangle whose angles are 70°, 30° and 80°.

(v) Two concentric circles do not intersect.

(vi) The distance between the two parallel lines is the same everywhere.

5. Draw a line-segment AB of length 4.2 cm. Using ruler and compass alone, bisect it. Measure each part.

6. Draw a line-segment CD. With ruler and compass alone, draw another line-segment CD, such the $CD = \frac{3}{2}$ AB.

7. Draw any line-segment AB. Using ruler and compass alone, draw a circle on AB as diameter.

8. With the help of a protractor, draw an angle of 75°. Using ruler and compass alone, bisect the angle. Measure each part.

9. Draw an angle BAC. Using ruler and compass alone, draw an angle EDF, such that $\angle EDF = \frac{3}{2}\angle BAC$.

10. Draw an angle BAC, and draw AX, its bisector ray. Take any point P on ray AX. Draw PM $\perp$ AB and PN $\perp$ AC, meeting AB and AC in M and N respectively. Measure PM and PN.

11. Draw two parallel lines at a distance 2.2 cm apart.

12. Draw an isosceles triangle with each of the equal sides of length 3 cm and the angle between them as 45°.

13. Draw an equilateral triangle, one of whose sides is of length 3 cm.

14. Draw a right triangle whose hypotenuse is of length 4 cm and one side is of length 2.5 cm.

15. Draw a triangle whose sides are of lengths 4 cm, 5 cm and 7 cm. Draw the perpendicular bisector of the largest side.

16. Draw a triangle ABC with BC = 3.2 cm, AB = 3.6 cm and $\angle B = 120^\circ$. Also, draw a perpendicular from A on BC.

17. Draw a right triangle having hypotenuse of length 5.4 cm, and one of

the acute angles of measure 60°. Measure the shortest side of the triangle.

18. Draw a triangle ABC in which BC = 6 cm, $\angle B = 30^\circ$ and $\angle C = 45^\circ$. Also draw a perpendicular from A on BC.

19. Draw a triangle ABC with AB = 3 cm, BC = 4 cm and $\angle B = 60^\circ$. Also, draw the bisectors of angles C and A of the triangle, meeting in a point O. Measure $\angle COA$.

20. Draw any triangle ABC. Bisect side AB at D. Through D, draw a line parallel to BC, meeting AC in E. Measure AE and EC.

21. Draw a line-segment AB of length 4 cm. Now, locate a point P such that AP = 3 cm, and BP = 3.5 cm. Through P, draw a line parallel to BC.

22. Draw a triangle ABC with AB = 6 cm, BC = 7 cm and CA = 8 cm. Using ruler and compass alone, draw

(i) the bisector AD of $\angle A$ and

(ii) perpendicular AL from A on BC. Measure $\angle LAD$.

23. Using ruler and compass alone, draw an angle of 60°.

24. Using ruler and compass alone, draw an angle of

(i) 30° (ii) 45° (iii) 90° (iv) 120°

25. Draw any triangle ABC. Using ruler and compass alone, draw ΔDEF such that $\angle B = \angle E$ and $\angle C = \angle F$. Measure $\angle A$ and $\angle D$. Are the angles equal ?

26. Draw a line-segment AB of length 4.8 cm. Take a point D, not on the line AB. Now, draw ΔABC, such that AD bisects $\angle A$, and D lies on BC.

27. Draw a line-segment AB of length 4.5 cm and take a point D not on the line AB. Now, construct ΔABC, such that D is the mid-point of BC.

28. Draw a circle with centre O and radius 2.5 cm. Draw a chord AB of the circle, such that AB = 4 cm. From O, draw $OM \perp AB$, meeting AB in M. Measure AM and MB. Are these equal ?

29. Draw a circle with centre O and radius 2.5 cm. Draw two chords AB and CD of the circle, each of the length 3.5 cm. From O, draw $OM \perp AB$ and $ON \perp CD$. Measure OM and ON. Are these equal ?

30. Draw an angle BAC of measure 60°, and take a point D in the interior of $\angle BAC$. Through D, draw lines respectively parallel to AB and AC, intersecting AC in E and AB in F. Measure $\angle EDF$. What figure is AFDE ?

4.4 More about Triangles

In questions 1 to 11, four alternatives are given for answers, out of which only one is correct. Choose the correct answer :

1. If in ΔABC, $AB = AC$ and $\angle B = 40^\circ$, then $\angle C$ equals

   (a) 40° (b) 80° (c) 100° (d) 140°

2. If in ΔABC, $BC = AB$ and $\angle B = 80^\circ$, then $\angle C$ equals

   (a) 30° (b) 50° (c) 80° (d) 100°

3. If in ΔABC, $\angle C = \angle A$ and $BC = 5$ cm, then AB equals

   (a) 4 cm (b) 5 cm (c) 6 cm (d) 10 cm

4. If in ΔABC, $AB = 7$ cm, $BC = 24$ cm and $AC = 25$ cm, then the triangle is right angled at

   (a) A (b) B (c) C (d) None of these

5. If in ΔABC, $\angle C = 90^\circ$, $AC = 3$ cm and $BC = 4$ cm, then AB equals

   (a) 3.5 cm (b) 5 cm (c) 7 cm (d) 25 cm

6. If one of the angles of a triangle is 130°, then the angle between the bisectors of the other two angles is

   (a) 50° (b) 65° (c) 145° (d) 155°

7. In a right triangle ABC right angled at C, if $\angle B = 2 \angle A$, then

   (a) $AC = 2BC$ (b) $AB = 2BC$

   (c) $BC = 2AC$ (d) $AB + BC = AC$

8. If AD is a median of an equilateral triangle ABC, then

(a) $AB^2 = 2AD^2$ (b) $2AB^2 = 3AD^2$

(c) $3AB^2 = 4AD^2$ (D) $4AB^2 = 5AD^2$

9. P, Q and R are respectively the mid-points of the sides BC, CA and AB of ΔABC. The orthocentre of ΔPQR is the

(a) orthocentre of ΔABC

(b) circumcentre of ΔABC

(c) incentre of ΔABC

(d) centroid of ΔABC

10. The side QR of ΔPQR has been produced to a point S. If the bisectors of $\angle PRS$ and $\angle PQR$ intersect each other at M, then

(a) $\angle P = \angle M$ (b) $\angle P + \angle M = 180^o$

(c) $\angle P = 2\angle M$ (d) $\angle M = 2\angle P$

11. If D is a point on side BC of ΔABC such that AD bisects $\angle BAC$, then

(a) BA > BD (b) BD = CD

(c) BD > BA (d) Insufficient data to predict

12. Fill in the blanks in each of the following so as to make the statement true :

(a) In an isosceles triangle, the angles opposite equal sides are . . . .

(b) In a right triangle, if c is the length of the hypotenuse and a, b the lengths of the sides, then c^2 = ...

(c) In a triangle, if two of the angles are equal, then the sides opposite them are also . . . .

(d) If a, b, c are the lengths of the sides of a triangle and $a^2 + c^2 = b^2$, then . . . a right angle.

(e) (5, 12, 13) is Pythagorean triplet of numbers, since . . . .

(f) In a right triangle, the . . . is the longest side.

(g) The shortest distance from a point to a line is . . . .

(h) The point common to all the altitudes of a triangle is called its . . . .

(i) In . . . triangle, the orthocentre, the centroid, the circumcentre and the incentre coincide.

(j) The point common to all the medians of a triangle is called its . . . .

13. Fill in the blanks in each of the following so as to make the statement true :

(a) If H is the orthocentre of ΔABC, then BH is perpendicular to the line containing the side . . . .

(b) If I is the incentre of ΔABC, then AI bisects . . . .

(c) If G be the centroid of ΔABC, then CG bisects . . . .

(d) In a right triangle, the circumcentre is at . . . .

(e) In a right triangle, the orthocentre is at . . . .

14. In each of the following, state if the statement is true (T) or false (F)

(i) The incentre of a triangle always lies in the interior of the triangle.

(ii) A median of a triangle bisects a side of the triangle.

(iii) The altitudes of a triangle have a common point which always lies in the interior of the triangle.

(iv) The circumcentre of a triangle is equidistant from the three vertices of the triangle.

(v) The circumcentre of a triangle always lies in the interior of the triangle.

(vi) The centroid of a triangle always lies in the interior of the triangle.

(vii) If G is the centroid of ΔABC and AD one of its medians, then G lies on AD and AG : GD = 2 : 1.

15. One of the base angles of an isosceles triangle is of 70°. Find the vertex angle of the triangle.

16. ABC and DBC are two isosceles triangles on a common base BC such that D lies in the interior of ΔABC. If $\angle A = 50^\circ$ and $\angle D = 80^\circ$, find $\angle ABD$.

17. ΔABC is right angled at C and D is a point on side AB such that $\angle ACD = \angle A$. State with reasons if the following are true :

(i) AD = DC (ii) $\angle B = \angle BCD$

(iii) BD = DC (iv) AD = DB

18. The sides of a triangle are of lengths 6 cm, 4.5 cm and 7.5 cm. Is this triangle a right triangle ? If so, which side is the hypotenuse ?

19. The median from a vertex of ΔABC is perpendicular to the opposite side. Is ΔABC isosceles ? Give reasons.

20. In Δ ABC, AD is the median,G is the centroid and AL is the altitude such that L lies between B and D. Given that GD = 5cm, and L. D = 9cm, find the length of AL.

21. In a triangle ABC, $\angle ABC = 100^\circ$, $\angle BAC = 35^\circ$ and BD $\perp$ AC meets side AC in D. If BD = 2 cm, find $\angle C$ and length DC.

22. Show by paper folding that the median to the base of an isosceles triangle is an axis of symmetry of the triangle.

State the properties of an isosceles triangle that you observe from this experiment.

23. Two vertical poles 5.5 m and 4.3 m long stand on a level ground, 1.6 cm apart. Find the distance between their tops.

24. Given three non-collinear points A, B and C, draw a circle passing through them. Measure the radius of the circle.

25. In a triangle ABC, AD is the altitude from A such that AD = 12 cm, BD = 9 cm and DC = 16 cm. Examine if ΔABC is right angled at A.

26. D is the point on the hypotenuse AB of ΔABC, such that AD = AC. Also, N is the foot of the perpendicular from C on AB and N lies between D and A. Given that $\angle A = 60^\circ$, find $\angle DCN$. Does DC bisect $\angle BCN$?

27. In ΔPSR, PS = PR and side SP is produced to O, such that PO = PR. If $\angle SPR = x^\circ$, find $\angle SRO$. Does $\angle SRO$ depend on x ?

28. Two isosceles triangles ABC and ADC with AB = AC = AD, have a common vertex A, and a common side AC, B and D being on the same side of AC. Also $\angle BAC = 80^\circ$ and $\angle DAC = 110^\circ$. If BD is joined, find all the angles of ΔBDC.

29. Draw a line-segment AB and take a point G outside it. Construct a triangle ABC whose centroid is G.

30. Suppose you are given a triangle ABC and a point P in its place. How will you find whether P is

(i) the incentre of the triangle ?

(ii) the centroid of the triangle ?

(iii) The circumcentre of the triangle ?

4.5 Congruent Figures

In questions 1 to 5, four alternatives are given for answers, out of which only one is correct. Choose the correct answer :

1. In PQR, the angle included between sides PR and QR is

(a) $\angle P$ (b) $\angle Q$ (c) $\angle R$ (d) none of

2. In ΔDEF, the side included between E and F is

(a) DE (b) EF (c) FD (d) none of these

3. If $\Delta ABC \cong \Delta LKM$, then side of ΔLKM equal to side AC of ΔABC is

(a) LK (b) KM (c) LM (d) none of these

4. If $\Delta ABC \cong \Delta ACB$, then ΔABC is isosceles with

(a) AB = AC (b) AB = BC

(c) AC = BC (d) none of these

5. If $\Delta ABC \cong \Delta PQR$ and ΔABC is not congruent to ΔRPQ, then which of the following is not true :

(a) BC = PQ (b) AC = PR

(c) AB = PQ (d) QR = BC

6. Fill in the blanks, in each of the following, so as to make the statement true :

(a) Two triangles are congruent if two sides and . . . of the one triangle are respectively equal to the . . . parts of the other.

(b) Two triangles are congruent if two angles and . . . of one triangle are respectively equal to the . . . parts of the other.

(c) Two triangles are congruent if . . . sides of one triangle are respectively equal to . . . .

(d) Two right triangles are congruent if the . . . and a side of one triangle are respectively equal to . . . .

(e) If $\Delta ABC \cong \Delta FDE$, then

(i) $AB = \ldots$ (ii) $BC = \ldots$

(iii) $AC = \ldots$ (iv) $\angle A = \ldots$

(v) $\angle B = \ldots$ (vi) $\angle C = \ldots$

7. In each of the following, state if the statements are true (T) or false (F):

(i) For every line-segments $\overline{AB}$, it is true that $\overline{AB} \cong \overline{AB}$.

(ii) If AB and CD are line-segments such that $\overline{AB} \cong \overline{CD}$, then also $\overline{CD} \cong \overline{AB}$.

(iii) If $\overline{AB}$, $\overline{CD}$ and $\overline{EF}$ are three line-segments such that $\overline{AB} \cong \overline{CD}$ and $\overline{CD} \cong \overline{EF}$, then $\overline{AB} \cong \overline{EF}$.

(iv) If $\overline{AB}$ and $\overline{CD}$ are line-segments such that $AB > CD$, then there is a point E on $\overline{AB}$ such that $\overline{AE} \cong \overline{CD}$.

(v) All right angles are congruent.

(vi) Every angle is congruent to its supplement.

(vii) If two angles are congruent, their supplements are also congruent.

(viii) If $\angle BAC > \angle EDF$, then there is ray AX with X in the interior of $\angle BAC$ such that $\angle BAX \cong \angle EDF$.

8. In each of the following, there are three equality relations between some parts of ΔABC and those of ΔPQR. State which of the congruence

conditions SAS, ASA, SSS, or RHS applies: (Write none, if none of them applies.)

(a) $AB = QP$, $\angle B = \angle P$, $BC = PR$

(b) $AC = PR$, $\angle A = \angle P$, $BC = QR$

(c) $\angle A = \angle R$, $\angle B = \angle P$, $AB = RP$

(d) $\angle A = \angle R$, $\angle C = \angle Q$, $AC = PQ$

9. If $\Delta PQR \cong \Delta EFD$,

(i) which side of ΔPQR equals ED ?

(ii) which angle of ΔPQR equals $\angle E$?

10. In each of the following pairs of triangles (Fig. 4.7), congruent parts are indicated by like signs. Are the two triangles congruent ? Answer, 'Yes' or 'No'. Which condition SAS, ASA, SSS or RHS have you used?

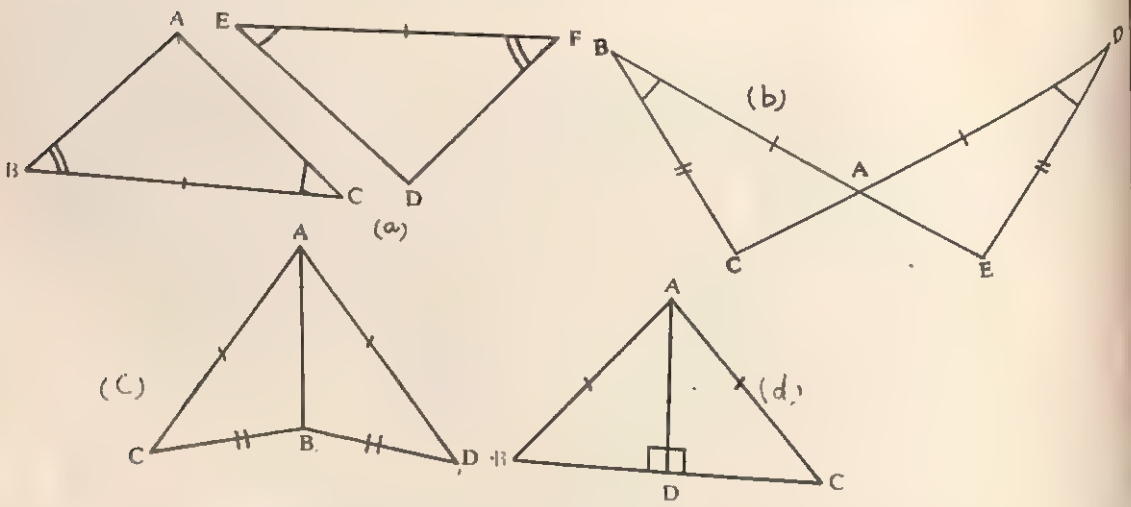


Fig 4.7

11. Line-segments AB and CD bisect each other at O. AC and BD are joined forming triangles OAC and OBD.

State the three equality relations between the parts of the two triangles, that are given or otherwise known.

Are the two triangles congruent ? State in symbolic form. Which congruence condition do you use ?

12. ΔABC is isosceles with AB = AC. Also, AD $\perp$ BC, meeting BC in D. Are the two triangles ABD and ACD congruent ? State in symbolic form. Which congruence condition do you use ? Which side of ΔADC equals BD ? Which angle of ΔADC equals $\angle B$?

13. Triangles ABC and DBC have side BC common, AB = BD and AC = CD. Are the two triangles congruent ? State in symbolic from. Which congruence condition do you use ? Does $\angle ABD$ equal $\angle ACD$? Why or why not ?

14. In Fig. 4.8, AB = DC and AD = BC. Which two triangles in the figure are congruent ? State in symbolic form.

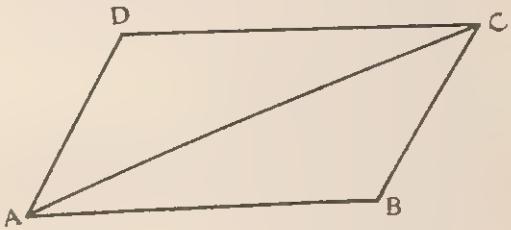


Fig. 4.8

15. Triangles ABC and PQR are both isosceles with AB = AC and PQ = PR respectively. If also, AB = PQ and BC = QR, are the two triangles congruent ? Which condition do you use ? If $\angle B = 50^\circ$, what is the measure of $\angle R$?

16. ABC and DBC are both isosceles triangles on a common base BC such that A and D lie on the same side of BC. Are triangles ADB and ADC congruent ? Which condition do you use ? If $\angle BAC = 40^\circ$ and $\angle BDC = 100^\circ$, then find $\angle ADB$.

17. ABC and DBC are both isosceles triangles on a common base BC such that A and D lie on opposite sides of BC. AD is joined intersecting BC in M. Point out pairs of congruent triangles. State the answer in symbolic form. If $\angle A = 80^\circ$ and $\angle D = 50^\circ$, find $\angle ABD$.

18. Draw a right triangle ABC. Use RHS condition to construct another triangle congruent to it.

19. Draw any triangle ABC. Use ASA condition to construct another triangle congruent to it.

20. ABCD is a square. X is any point on BD. AX and CX are joined. Is AX = CX ? Give reasons.

21. ΔABC is isosceles with AB = AC. BE and CF are the bisectors of $\angle B$ and $\angle C$ respectively (Fig.4.9). It appears that BE and CF are equal. Find out whether it is actually so.

(i) Name a pair of triangles, of which BE and CF are the corresponding sides.

(ii) Which equality relations between the parts of the two triangles are known? State them.

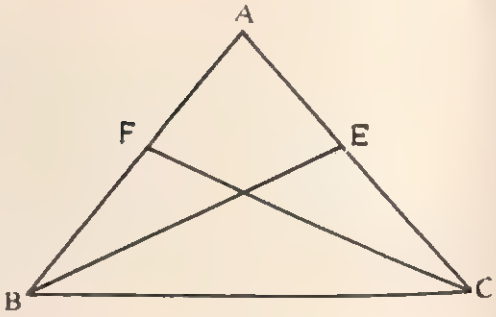


Fig. 4.9

22. ABCD is a square of side 2 cm (Fig. 4.10). Sides AB and BC are produced to P and Q respectively such that BP = CQ = 1 cm. AQ and DP are joined. Is AQ = DP ? Give reasons.

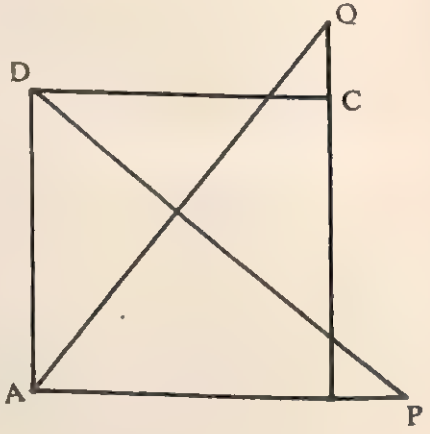


Fig. 4.10

23. Fig 4.11 indicates how you may find the width of a river without crossing it. Here P and Q are points on the opposite banks of the river, so that PQ is perpendicular to each bank. Explain the figure. Which length equals PQ ? Why ?

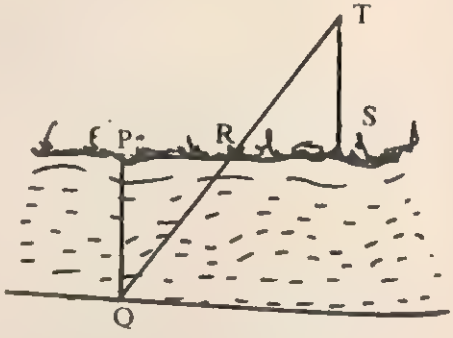


Fig. 4.11

24. Fig.4.12 indicates how to bisect a given angle. How do you make sure, without measurement that ∠EAF = ∠FAB ?

(*Hint:* Consider triangles ADF and AEF for congruence.)

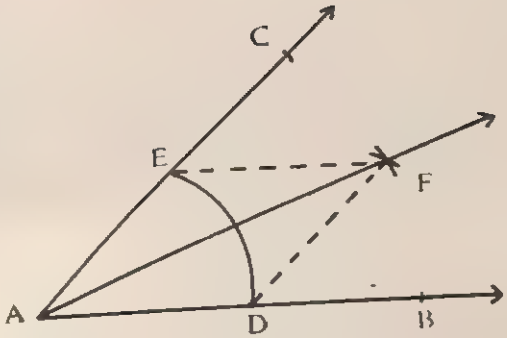


Fig. 4.12

25. Fig. 4.13 indicates how we draw the perpendicular PM to a line l from a point outside it. Without measuring ∠PMR or ∠PMQ, can you say that PM⊥ l ? How?

(*Hint* : ∠PMR = 90^0, if ∠PMR = ∠PMQ . ΔMPQ ≅ ΔMPR, if ∠MPQ = ∠MPR. Is it so ? For this consider triangles PQS and PRS.)

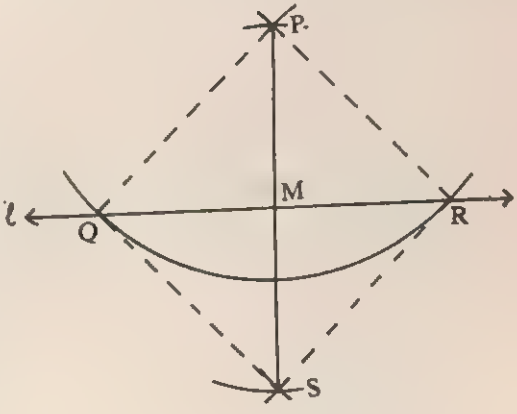


Fig. 4.13

26. Fig. 4.14 indicates another method of drawing a perpendicular to a line l from a point P outside it. It is as follows :

Join AP. Draw ∠QAM = ∠PAM such that AP = AQ. Without measuring can you say that PM ⊥ l ? How ?

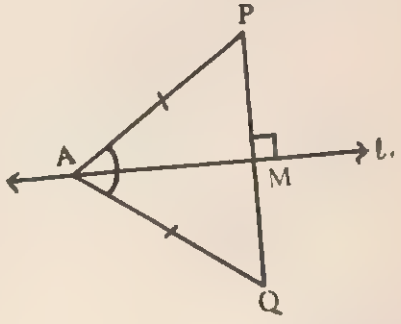


Fig. 4.14

4.6 Quadrilateral

In questions 1 to 10, four alternatives are given for answers out of which only one is correct. Choose the correct answer :

1. Three angles of a quadrilateral are 75°, 90° and 75°. The fourth angle of the quadrilateral is

   (a) 90° (b) 95° (c) 105° (d) 120°

2. The diagonals of a parallelogram ABCD intersect at O. If $\angle BOC = 90^\circ$ and $\angle BDC = 50^\circ$, then $\angle OAB$ is

   (a) 10° (b) 40° (c) 50° (d) 90°

3. If the diagonals of a rhombus are 12 cm and 16 cm, then each side of the rhombus is

   (a) 10 cm (b) 14 cm (c) 20 cm (d) 28 cm

4. A diagonal of a rectangle is inclined to one side of the rectangle at 25^0. The acute angle between the diagonals is

   (a) 25° (b) 40° (c) 50° (d) 55°

5. ABCD is a rhombus. If $\angle ACB = 40^\circ$, then $\angle ADB$ is

   (a) 40° (b) 45° (c) 50° (d) 60°

6. The quadrilateral formed by joining the mid-points of the sides of a quadrilateral PQRS, taken in order, is a rectangle if
   (a) PQRS is a rectangle
   (b) PQRS is a parallelogram
   (c) diagonals of PQRS are perpendicular
   (d) diagonals of PQRS are equal

7. The quadrilateral formed by joining the mid-points of the sides of quadrilateral PQRS, taken in order, is a rhombus if
   (a) PQRS is a rhombus
   (b) PQRS is a parallelogram
   (c) diagonals of PQRS are perpendicular
   (d) diagonals of PQRS are equal

8. If angles P,Q,R and S of the quadrilateral PQRS, taken in order, are in the ratio 3 : 7 : 6 : 4, then PQRS is a

(a) rhombus
(b) parallelogram
(c) trapezium
(d) kite

9. If PQ and RS are two perpendicular diameters of a circle, then PRQS is a

(a) rectangle but not square
(b) trapezium
(c) square
(d) rhombus but not square

10. If bisectors of $\angle A$ and $\angle B$ of quadrilateral ABCD intersect each other at P, of $\angle B$ and $\angle C$ at Q, of $\angle C$ and $\angle D$ at R and of $\angle D$ and $\angle A$ at S, then PQRS is a

(a) rectangle
(b) rhombus
(c) parallelogram
(d) quadrilateral whose opposite angles are supplementary

11. Fill in the blanks, in each of the following, so as to make the statement true:

(a) The sum of the angles of a quadrilateral is . . . .
(b) The opposite angles of a parallelogram are . . . .
(c) The opposite sides of a parallelogram are . . . .
(d) The diagonals of a parallelogram . . . .
(e) A rectangle is a parallelogram in which . . . .
(f) A rhombus is a parallelogram in which . . . .
(g) A square is a rhombus in which . . . .
(h) A square is a rectangle in which . . . .
(i) A trapezium is a quadrilateral in which . . . .

12. In each of the following, state if the statement is true (T) or false (F) :

(i) The diagonals of a rectangle are equal.

(ii) The diagonals of a rhombus are equal and perpendicular.

(iii) The diagonals of a square are equal and perpendicular to each other.

(iv) The diagonals of a parallelogram are equal and bisect each other.

(v) The diagonals of a trapezium are equal and bisect each other.

13. For each of the following, state if it is always true (A), sometimes true (S) or never true (N):

(a) The diagonals of a parallelogram are equal.

(b) The diagonals of a parallelogram bisect each other.

(c) The diagonals of a parallelogram are perpendicular.

(d) The diagonals of a square are equal and perpendicular.

(e) The diagonals of a rectangle are equal and perpendicular.

14. The angles of a quadrilateral are 110°, 72°, 55° and x°. Find the value of x.

15. One angle of a quadrilateral is 108° and the remaining three angles are equal. Find the three equal angles.

16. ABCD is a trapezium in which AB || DC and $\angle A = \angle B = 45^\circ$. Find $\angle C$ and $\angle D$. Are these angles equal ?

17. A pair of consecutive (adjacent) angles of a parallelogram are in the ratio 2 : 3. Find each angle of the parallelogram.

18. In a quadrilateral ABCD, $\angle A + \angle D = 180^\circ$. Does this mean AB || DC ? Why ? What special name does this quadrilateral have ?

19. All the angles of a quadrilateral are equal to each other. Find the measure of each. Is the quadrilateral a parallelogram ? Why ? What special type of a parallelogram, is it ?

20. The diagonals of a rectangle ABCD intersect in O. If $\angle BOC = 68^\circ$, find $\angle ODA$.

21. Draw a rectangle with one side of length 4 cm and diagonal of length 5 cm.

22. In Fig.4.15, BDEF and DCEF are each a parallelogram. Is it true that BD = DC ? Why or why not ?

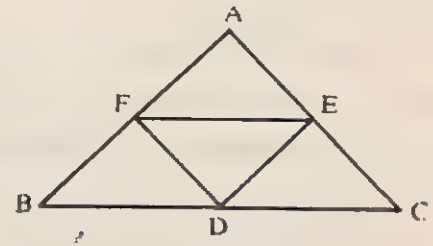


Fig. 4.15

23. In the figure of question 22 above, suppose it is known that DE = DF. Then, is ΔABC isosceles ? Why or why not ?

24. In a parallelogram ABCD, the bisectors of $\angle A$ and $\angle B$ meet at O. Find $\angle AOB$.

25. Construct a rhombus whose diagonals are of length 10 cm and 6 cm.

26. Draw a rhombus, having each side of length 3.5 cm and one of the angles as 40°

27. In Fig. 4.16, ABCD and AEFG are each a parallelogram. If $\angle C = 55^\circ$, what is the measure of $\angle F$?

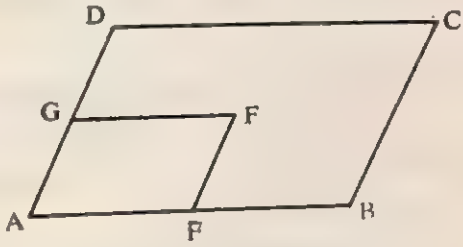


Fig. 4.16

28. The angle between two altitudes of a parallelogram,through the same vertex of an obtuse angle of the parallelogram is 60°. Find the angles of the parallelogram.

29. ABCD is a rhombus in which the altitude from D to side AB bisects AB. Find the angles of the rhombus.

30. AC is a diagonal of a quadrilateral ABCD in which AB = DC and AD = BC. Is $\angle CAB = \angle ACD$ and $\angle ACB = \angle CAD$? Why or why not ? From this, can you that AB $\parallel$ CD and AD $\parallel$ BC ? How ? What special type of a quadritateral is ABCD ?

31. X and Y are respectively the mid-points of sides AB and BC of a parallelogram ABCD. DX and DY intersect AC at M and N

respectively. If AC = 4.5 cm, find MN.

32. Points E and F lie on diagonal AC of a parallelogram ABCD such that AE = CF. What type of a quadrilateral is BFDE ?

33. In rectangle ABCD, AB = 25 cm and BC = 15 cm. In what ratio does the bisector of $\angle C$ divide AB ?

34. P, Q, R and S are points on the sides AB, BC, CD and DA respectively of a parallelogram ABCD such that AP = CQ and AS = CR. If QR = 2.5 cm, what is the length of PS ? Is it also true that PR = QS ? What type of a quadrilateral is PQRS ?

35. Diagonals of a parallelogram ABCD intersect at O. AL and CM are drawn perpendiculars to BD such that L and M lie on BD. Is AL = CM ? Why or why not ?

36. In a parallelogram ABCD, AB = 10 cm, AD = 6 cm. The bisector of $\angle A$ meets DC in E. AE and BC produced meet at F. Find the length of CF.

37. The angles of a quadrilateral are in the ratio 1 : 3 : 7 : 9. What type of a quadrilateral is it ?

38. ABCD is a rectangle. The perpendicular DN from D on AC, divides $\angle D$ in the ratio 2 : 3. Find $\angle NDB$.

39. [A trapezium, whose non-parallel sides are equal is called an isosceles trapezium.] ABCD is a trapezium in which AB $\parallel$ CD and $\angle A = \angle B$. Is it an isosceles trapezium ? Why or why not ?

40. A square is inscribed in an isosceles right triangle so that the square and the triangle have one angle common. Show that the vertex of the square opposite the vertex of the common angle bisects the hypotenuse.

41. There are two trees A and B on the ground such that a part of the line-segment AB falls in a pond (Fig.4.17). Explain, how you will use the properties of a rectangle to find the distance AB without going into the pond.

Fig. 4.17

42. Diagonal AC of parallelogram ABCD bisects $\angle A$.

(a) Does AC bisects $\angle C$ also ? Give reasons.

(b) Is ΔACD isosceles ? Give reasons.

(c) Is ABCD a rhombus ? Give reasons.

(d) Does diagonal BD bisect $\angle B$? Give reasons.

43. One side of a rhombus is of length 4 cm and the length of an altitude is 3.2 cm. Draw the rhombus.

44. The diagonals AC and BD of a parallelogram ABCD bisect each other at O. A line-segment XY through O has its end-points on the opposite sides AB and CD. Is XY also bisected at O ?

UNIT FIVE

Mensuration

5.1 Areas

In questions 1 to 24, four alternatives are given for answers, out of which only one is correct. Choose the correct answer :

1. A square metre is equal to

(a) 100 cm^2 (b) 1000 cm^2

(c) 10000 cm^2 (d) 100000 cm^2

2. A square metre is equal to

(a) 10 dm^2 (b) 100 dm^2

(c) 1000 dm^2 (d) 10000 dm^2

3. A square metre is equal to

(a) 1000 mm^2 (b) 10000 mm^2

(c) 100000 mm^2 (d) 1000000 mm^2

4. An *are* is the area of a square of side

(a) one metre (b) one decametre

(c) one hectometre (d) one kilometre

5. One hectare is equal to

(a) 10 m^2 (b) 100 m^2

(c) 1000 m^2 (d) 10000 m^2

6. One square kilometre is not equal to

(a) $100000\ m^2$ (b) 10000 *are*

(c) 100 hectares (d) $10000\ dam^2$

7. One square decimetre is not equal to

(a) $\frac{1}{100}\ m^2$ (b) $\frac{1}{1000}\ dam^2$

(c) $\frac{1}{10000}$ *are* (d) $\frac{1}{1000000}$ ha

8. One square centimetre is not equal to

(a) $10^2\ mm^2$ (b) $10^{-2}\ dm^2$

(c) 10^{-4} *are* (d) 10^{-8} ha

9. One *centiare* is equal to

(a) $1\ m^2$ (b) $1\ cm^2$

(c) $10\ m^2$ (d) $100\ mm^2$

10. If the perimeter of a square is 20 m, then its area is

(a) $25\ m^2$ (b) $80\ m^2$

(c) $100\ m^2$ (d) $400\ m^2$

11. The length and area of a rectangle are respectively 15 cm and $150\ cm^2$. Its perimeter is

(a) 10 cm (b) 25 cm

(c) 30 cm (d) 50 cm

12. The length of the side of a square of area 1 *are* is

(a) 1 m (b) 10 m

(c) 40 m (d) 100 m

13. Area (in cm^2) of a square of perimeter 1 m is

(a) 1 (b) 25

(c) 625 (d) 10000

14. Area (in m^2) of a square of side 90 cm is

(a) .81 (b) 810

(c) 900 (d) 9000

15. If the length of the side of a square is doubled, its area will be

(a) the same as original square.

(b) two times that of original square.

(c) three times that of original square.

(d) four times that of original square.

16. If the area of a square of side 24 cm is equal to the area of a rectangle of length 18 cm, then the breadth of the rectangle will be

(a) 12 cm (b) 24 cm

(c) 30 cm (d) 32 cm

17. The length of a rectangle is doubled and its breadth is halved. Its area will be

(a) half of the original area.

(b) the same as original area.

(c) two times the original area.

(d) four times the original area.

18. Each side of a rectangle is increased by 20% . Its area will increase by

(a) 10% (b) 20%

(c) 40% (d) 44%

19. The area (in *ares*) of a garden of dimensions 50 m × 40 m is

(a) 0.2 (b) 2 (c) 20 (d) 200

20. The number of square cards of side 10 cm that can be stuck on a cardboard of dimensions 100 cm by 80 cm is

(a) 40 (b) 80

(c) 100 (d) 180

21. If the perimeter of a rectangle is p cm and the area is A cm^2, then

(a) $p > A$ (b) $p = A$ (c) $p < A$

(d) for some rectangles $p > A$, for some rectangles $p = A$ and for some rectangles $p < A$

22. For two rectangles with perimeter p_1 and p_2 and areas A_1 and A_2, consider the statements

(i) If $p_1 = p_2$, then $A_1 = A_2$.

(ii) If $A_1 = A_2$, then $p_1 = p_2$.

Now state which of the following is correct :

(a) both (i) and (ii) are true.

(b) (i) is true but (ii) is false.

(c) (ii) is true but (i) is false.

(d) both (i) and (ii) are false.

23. If parallelogram with area P, a rectangle with area R and a triangle with area T are all constructed on the same base and all have the same altitude, then a false statement is

(a) $P = 2T$ (b) $T = \frac{1}{2}R$

(c) $P = R$ (d) $P + T = 2R$

24. Two sides of a right triangle are of length 1 cm each. The area of the triangle in cm^2 is

(a) $\frac{1}{2}$ (b) 1

(c) 2 (d) 4

25. Fill in the blanks in each of the following so as to make the statement true:

(a) A rectangle together with _____ is called a rectangular region.

(b) The area of a square _____ is called one square metre.

(c) $1\ m^2 =$ _____ cm^2

(d) The area of a rectangle = _____ × _____

(e) The area of a _____ = $(side)^2$

(f) The perimeter of a rectangle = 2 (____ + _____)

(g) The perimeter of a square = _____

(h) The area of a _____ = $\frac{1}{2}$ base × altitude

(i) If a triangle and a parallelogram are on the same base and have the same height, then area of the parallelogram is _____ the area of the triangle.

(j) The square dial of a wrist watch is of side 3 cm. Its area is _____ cm^2.

(k) The cover page of a book is 14 cm broad and 20 cm long. If such 100 books are arranged side by side, they will cover _____ sq. m area.

(l) A sheet is 40 cm long and 33 cm broad. We can arrange _____ squares on it having side 3 cm.

(m) Length of a rectangle is 40 cm and breadth is _____ cm. It has the same area as a square of side 60 cm.

(n) The area of a rectangle of length 40 cm and breadth 25 cm is _____ the area of a square of side 35 cm.

(o) The rectangle of a given area and _____ perimeter is a square.

(p) The rectangle of a given perimeter and the largest area is a _____.

26. Fill in the blanks in each of the following so as to make the statement true :

(a) Area of a rectangular field of dimensions 18 m by 13 m is _____ m^2.

(b) Area of a rectangular field is 18 hectares. If its length is 900 m, its breadth is _____ m.

(c) Perimeter of a rectangle is 50 cm. If its length is 15 cm, its area is _____ cm^2.

(d) Area of a square is equal to the area of a rectangle of dimensions 180 m × 20 m. Perimeter of the square is _____ m.

(e) Area of a square plot is 4 *ares*. The cost of fencing it at the rate of Rs 4 per metre is Rs _____.

(f) Number of square pieces of side 5 cm that can be cut from a paper 40 cm long and 25 cm broad is _____.

27. In each of the following, state if the statement is true (T) or false (F) :

(i) A square board of perimeter 4 m has the area 16 m^2.

(ii) Area of a square of side 20 cm and that of a rectangle of length 24 cm and breadth 16 cm are equal.

(iii) The ratio of the area of a square of side 6 cm to that of a rectangle of length 5 cm and breadth 3 cm is 12 : 5.

(iv) Area of a square of side 6 cm is three times the area of the square of side 2 cm.

(v) Areas of all the pages of a book are equal.

(vi) Area of a rectangular blackboard 3 m long and 2 m broad is 10 m^2.

(vii) 1 hectare = 1000 m^2

(viii) 1 *are* = 100 m^2

(ix) Perimeter of a square of side 5 m is equal to the perimeter of a rectangle of dimensions 6 m × 4 m.

(x) A rectangular sheet of length 8 cm has perimeter 32 cm.

(xi) Area of a triangle is equal to base × corresponding altitude.

(xii) Base of a parallelogram is equal to 2 Area ÷ corresponding altitude.

28. Match the items of column A with those of column B, where l, b, etc. have their usual meanings :

Column A	*Column B*
(i) Area of a square	(a) $\frac{1}{2}$ b × h
(ii) Area of a rectangle	(b) $2l + 2b$
(iii) Area of a triangle	(c) l^2
(iv) Area of a parallelogram	(d) $l \times b$
(v) Perimeter of a square	(e) $\frac{2A}{b}$
(vi) Perimeter of a rectangle	(f) b × h
(vii) Altitude of a triangle	(g) $\frac{A}{h}$
(viii) Base of a parallelogram	(h) $4l$

29. Find the area (in cm^2) of a rectangle whose

(i) length = 3.9 cm, breadth = 1.1 cm
(ii) length = 2.7 dm, breadth = 1.9 cm
(iii) length = 78 mm, breadth = 9 mm
(iv) length = 5 m, breadth = 2.3 dm
(v) length = 12 dam, breadth = 1.9 mm

30. Find the area (in m^2) of a square whose side is

(i) 1.7 m (ii) 29 cm (iii) 155 m
(iv) 78 dam (v) 1 m 25 mm

31. Complete the table in respect of a number of rectangles:

Length	*Breadth*	*Perimeter*	*Area*
1.9 cm	1.3 cm	_____	_____
15 cm	_____	_____	225 cm^2
_____	16 cm	2.4 dam	_____

32. Compare the areas of the following three figures:

(i) Square of side 80 cm

(ii) Rectangle of length 4 m and breadth 16 cm

(iii) Triangle of base 8 dm and altitude 1 m 50 cm

33. What would happen to the area of a rectangle if its

(i) length is doubled and width is halved ?

(ii) length is halved and breadth is doubled ?

(iii) length and breadth both are halved ?

34. A rectangular paper sheet is 30 cm long and 20 cm broad. Find its area.

35. The area of a rectangular garden is 5 *ares*. If its length is 25 m, find its breadth.

36. Find the area (in m^2) of the parallelograms whose bases and altitudes are as under:

(i) base = 15 dm, altitude = 1.9 dm

(ii) base = 230 cm, altitude = 27 cm

(iii) base = 79 m, altitude = 53 m

(iv) base = 85 dam, altitude = 13 m

(v) base = 960 mm, altitude = 43 cm

37. Complete the following in respect of a number of isosceles triangles:

Base	*Altitude*	*Perimeter*	*Area*
6 cm	4 cm	_____	_____
12 cm	_____	32 cm	_____
_____	12 cm	_____	108 cm^2
32 cm	_____	72 cm	_____

38. Find the area of a rhombus whose diagonals are

(a) 12 cm and 9 cm

(b) 12 cm and 16 cm

39. How many square centimetres of wall paper will be required for 16 walls, each measuring 2.4 m by 1.9 m ?

40. Find the area in hectares of a green belt whose length is 2400 m and breadth is 11 m.

41. One side of a rectangular field of area 7 ha is 35 dam. What is the length of the other side in metres ?

42. One side of a square field is 179 m. Find the cost of raising a lawn on the field at the rate of Rs 1.50 per square metre.

43. Find the cost of the mica used for the top of a table of size

19 dm 5 cm × 8 dm 5 cm at the rate of Rs 7.30 per 100 cm^2.

44. Find the area in *are* of a square field of side 49 m.

45. A rectangular field is measured 290 m by 210 m. How long will it take for a girl to go two times round the field, if she walks at the rate of 1.5 m per second ?

46. A rectangle has the area equal to that of a square of side 80 cm. If the breadth of the rectangle is 20 cm, find its length.

47. Area of a rectangle of breadth 17 cm is 340 cm^2. Find the perimeter of the rectangle.

48. The width of a cloth is 170 cm. Calculate the length of the cloth required to make 25 diapers, if each diaper requires a piece of cloth of size 50 cm by 17 cm.

49. Find the height of the wall whose length is 4 m and which can be covered by 2400 tiles of size 25 cm by 20 cm.

50. A 5m wide lane was paved with bricks of size 20 cm by 15 cm. If the rate of bricks was Rs 750 per thousand and if bricks worth Rs 49500 were used for pavement, find the length of the lane.

51. Two fields, one square and other rectangular have the same perimeter. If the rectangular field is of size 10.5 dam by 1.5 dam, find the area of the square field in *ares*.

52. The carpet for a room 6.6 m by 5.6 m costs Rs 3960 and it was made from a roll 70 cm wide. Find the cost of the carpet per metre.

53. Rakesh has a square field of side 70 m and Ahmed has a rectangular field of length 80 m and breadth 60 m. Who has the bigger field ? Find the difference of the areas of their fields in *ares*.

54. A corridor of a school is 8 m long and 6 m wide. It is to be covered with the canvas sheets. If the available canvas sheets have the size 2 m $\times$ 1 m, find the cost of canvas sheets required to cover the corridor at the rate of Rs 8 per sheet.

55. Find the perimeter of a rectangular field whose length is four times its width and which has an area equal to 30976 cm^2.

56. Find the area of an isosceles right triangle whose hypotenuse is 18 cm.

57. It is desired to pave a rectangular courtyard of length 8 m 5 dm 5 cm and width 5 m 2 dm 5 cm by square tiles of the same size. Find the largest size of the tile that can be used to cover the courtyard so that there is no need of breaking any tile. What is the number of such tiles?

58. The area of a rectangular field is calculated to be 250 m^2 when its sides are measured with a faulty metre rod. If that metre rod is actually .96 metre long, find the correct area of the field.

59. A 7 m wide path is constructed outside along the four sides of a field of dimensions 93 m by 79 m. What is the area of the path ?

60. One metre wide path is built inside a square park of side 30 m along its sides. The remaining part of the park is covered by grass. If the total cost of covering by grass is Rs 1176, find the rate per square metre at which the park is covered by grass.

61. Through a rectangular field of sides 90 m × 60 m, two roads are constructed which are parallel to the two sides and cut each other at right angles through the centre of the field. If the width of the roads is 3 m, find the total area covered by the two roads.

62. Dasappa has a rectangular field of length 80 m and breadth 60 m. In it, he wants to make a garden 10 m long and 4 m broad at one of the corner and at another corner, he wants to grow flowers in two flower-beds each of size 4 m by 1.5 m. In the remaining part of the field, he wants to apply manures. Find the cost of applying the manures at the rate of Rs 300 per *are*.

63. Aslam has a rectangular field of length 60 m and a square field of side 50 m. Both of these fields have the same perimeter. If in both the fields, he plants a mango tree in each one square metre, find the ratio of the numbers of trees planted in the two fields.

64. There is a rectangular field of size 94m × 32 m. Three roads each of 2m width pass through the field such that two roads are parallel to the breadth of the field and the third is parallel to the length. Calculate :

(a) area of the field covered by the three roads.

(b) area of the field not covered by the roads.

65. A poster of size 10 cm by 8 cm is pasted on a sheet of cardboard such that there is a margin of width 1.75 cm along each side of the poster. Find

(a) the total area of the margin.

(b) the cost of the cardboard used at the rate of Re 0.60 per cm^2.

66. A tin sheet is in the shape of a rhombus of altitude 40 dm. If the perimeter of the sheet is 26 dam, calculate the cost of painting the whole sheet at the rate of Rs 7.00 per m^2.

67. Find the area of a figure formed by a square of side 8 cm and an isosceles triangle with base as one side of the square and perimeter as 18 cm.

68. Calculate the area of quadrilateral field ABCD (Fig. 5.1) by dividing it into a rectangle and a triangle.

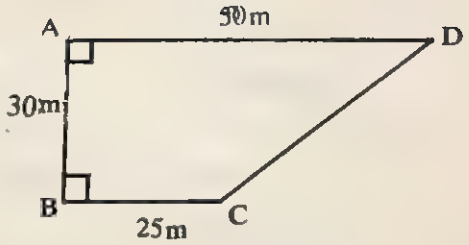


Fig. 5.1

69. Calculate the area of pentagon ABCDE, where AB = AE and with dimensions as shown in Fig 5.2.

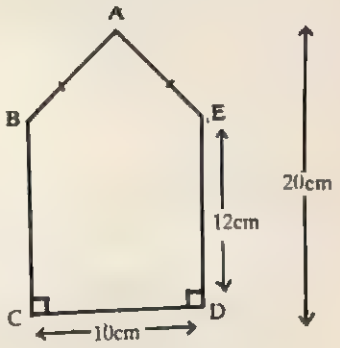


Fig. 5.2

70. From a rectangular sheet of paper, of size 100 cm by 80 cm, are cut four squares each of side 10 cm. From remaining piece of paper, an isosceles right triangle is removed. It the equal sides of the triangle are of 10 cm length, find the area of the remaining part of the paper.

71. A sheet of paper is of length 90 cm and breadth 60 cm. Four congruent isosceles triangles are cut from the corners to make the sheet a hexagon (a six sided figure). What is the area of the hexagon?

[*Hint* : Here the length of one of the two sides of the isosceles triangle is to be found first. What would happen if you take the side of the triangle less than this number ? Is it possible to have the side of length greater than this ?]

72. From the corners of a square piece of paper of side 80 cm are cut four identical isosceles triangles. If the size of the four triangles are such that the resulting figure is again a square, find the area of this square. How is it related to the area of the whole square ?

73. Find the area of the adjoining figure (Fig. 5.3) in the following two ways :

(a) Sum of the areas of three triangles.

(b) Area of a rectangle – sum of the areas of 5 triangles.

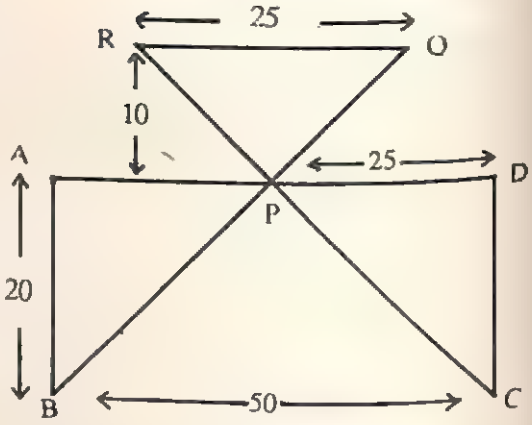


Fig. 5.3

74. Calculate the area of the adjoining figure (Fig. 5.4) as

(a) the sum of the areas of 5 squares.

(b) the sum of the area of a rectangle and the areas of two squares.

(c) the area of a square –(the sum of the areas of four squares).

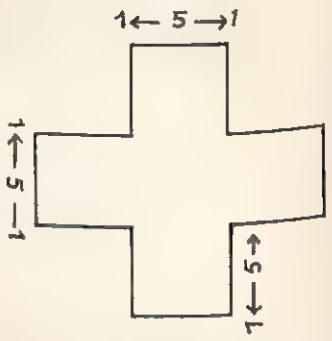


Fig. 5.4

75. Find the area of the adjoining figure (Fig. 5.5) in the following ways:

(a) Area of a rectangle + 4 (Area of a triangle)

(b) Area of a rectangle – [2 (Area of a rectangle) + 4 (Area of a triangle)]

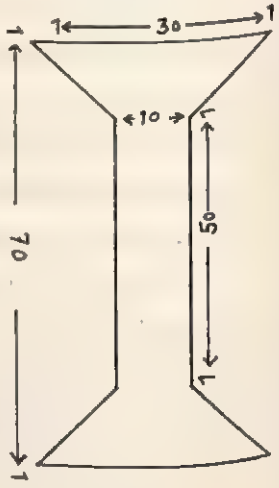


Fig. 5.5

76. Find the area of a trapezium whose parallel sides of lengths 10 cm and 15 cm are at a distance of 6 cm from each other. Calculate this area as

(a) the sum of the areas of two triangles and one rectangle.

(b) the difference of the area of a rectangle and the sum of the areas of two triangles.

77. Calculate the area of the adjoining figure (Fig. 5.6).

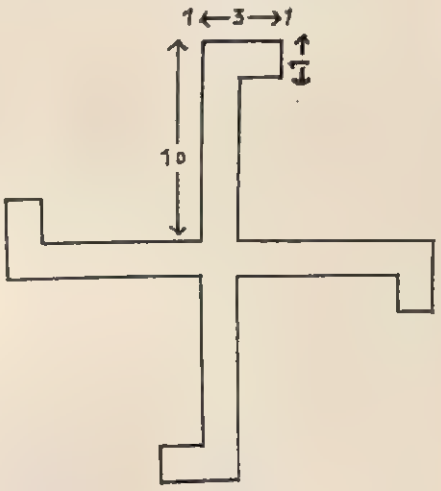


Fig. 5.6

78. Calculate the area of the adjoining figure (Fig. 5.7).

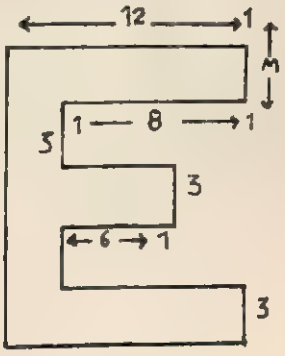


Fig. 5.7

79. Calculate the area of the adjoining figure (Fig 5.8).

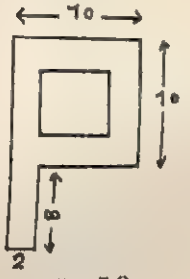


Fig. 5.8

80. Bhaskara, the learned, lived in Ujjain in the 12th century AD. Fig. 5.9 indicates his proof of Pythagoras Theorem.

Four right triangles, each with sides a and b, and hypotenuse c are arranged in a square such that a square of side (a–b) is left in the middle. Show that $c^2 = a^2 + b^2$.

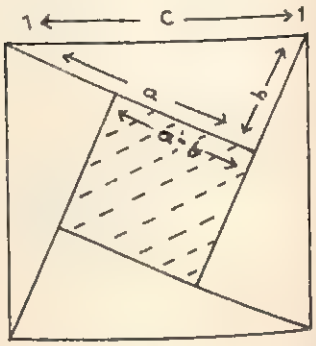


Fig. 5.9

81. In Fig 5.10, there is a square of side a+b, and four right triangles of sides a, b and hypotenuse c are arranged as shown to leave a square of side c in the middle. Show that $c^2 = a^2 + b^2$.

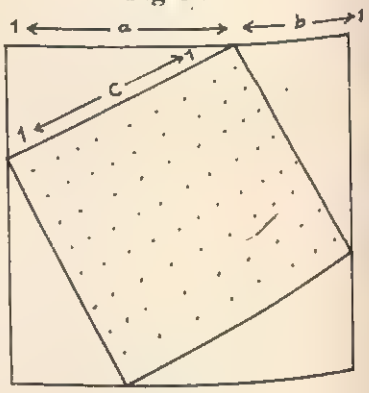


Fig. 5.10

5.2 Volumes and Surface Areas

In questions 1 to 15, four alternatives are given for answers, out of which only one is correct. Choose the correct answer:

1. The volume of a cube of side 1 dm is

(a) 100 cm^3 (b) 1000 cm^3

(c) .01 m^3 (d) .1m^3

2. The surface area of a cube of side 2 cm is

(a) 8 cm^3 (b) 24 cm^3

(c) 8 cm^2 (d) 24 cm^2

3. The number of 1-dm cubes that can be cut from a 1-m cube is

(a) 10 (b) 10^2

(c) 10^3 (d) 10^4

4. The number of 1-cm cubes that can be cut from a 1-m cube is

(a) 10^2 (b) 10^3

(c) 10^4 (d) 10^6

5. The surface area of a 10-cm cube is

(a) 1 dm (b) 1 dm^2

(c) 6 dm^2 (d) 6 dm^3

6. A hollow cubic container, without the lid, has its inner surface area as 20 cm^2. The edge of the container is

(a) 20 cm (b) 4 cm

(c) 2 cm (d) $\frac{20}{6}$ cm

7. The area of the floor of a room is 15 m^2. If its height is 4m, then the volume of the air contained in the room is

(a) 60 dm^3 (b) 600 dm^3

(c) 6000 dm^3 (d) 60000 dm^3

8. The cost of constructing a wall 8 m long, 4 m high and 20 cm thick at the rate of Rs 25 per m^3 is

(a) Rs 16 (b) Rs 80

(c) Rs 160 (d) Rs 320

9. A cuboidal tank 8 m long and 6 m broad contains 96000 litres of water. The height of the water level in the tank is

(a) 2 m (b) 0.2 m

(c) 20 m (d) 200 m

10. 10 cubic metres clay is uniformly spread on a land of area 10 *ares*. The rise in the level of the ground is

(a) 1 cm (b) 10 cm

(c) 100 cm (d) 1000 cm

11. Volume of a cuboid is 12 cm^3. The volume (in cm^3) of a cuboid whose sides are double of the above cuboid is

(a) 24 (b) 48

(c) 72 (d) 96

12. If the sum of all the edges of a cube is 36 cm, then the volume of that cube is

(a) 9 cm^3 (b) 27 cm^3

(c) 219 cm^3 (d) 729 cm^3

13. The number of cubes of side 3 cm that can be cut from a cuboid of dimensions 10 cm $\times$ 9 cm $\times$ 6 cm is

(a) 9 (b) 10

(c) 18 (d) 20

14. The surface area (in cm^2) of a cuboid of size 3 cm by 2 cm by 1 cm is

(a) 6 (b) 9

(c) 11 (d) 22

15. On a particular day, the rainfall recorded in a terrace 6 m long and 5 m broad is 15 cm. The quantity of water collected in the terrace is

(a) 300 litres (b) 450 litres

(c) 3000 litres (d) 4500 litres

16. Fill in the blanks in each of the following so as to make the statement true :

(a) A cuboid has _____ vertices.

(b) A cuboid has _____ edges.

(c) A cuboid has _____ faces.

(d) Each edge of a cuboid can be obtained as a line-segment in which two _____ meet.

(e) _____ edges of a cube (or cuboid) meet at each of its vertices.

(f) Each vertex of a cuboid can be obtained as a point where the three _____ of a cuboid meet.

(g) A cuboid all of whose edges are equal is called a _____.

(h) A cuboid has _____ lateral faces.

(i) 1 m^3 = _____ cm^3

(j) 1 litre = _____ cubic decimetre

(k) 1 kl = _____ m^3

(l) The volume of a cube of side 8 cm is _____ .

(m) The volume of a wooden block 4 m long, 50 cm broad and 50 cm thick is _____ m^3.

(n) The volume of a wooden cuboid of length 10 cm and breadth 8 cm is 4000 cm^3. The height of the cuboid is _____ cm.

17. In each of the following, state if the statemant is true (T) or false (F) :

(i) 1 cm^3 = 1 litre

(ii) The volume of a cube of side 4 cm is 96 cm^3.

(iii) Surface area of a cuboid of length 5 cm, breadth 4 cm and height 2 cm is 48 cm^2.

(iv) 1 m^3 = 100 litres

(v) The volume of a dice having all the six faces of 1 cm^2 area is 6 cm^3.

(vi) Number of faces in a cuboid and the number of faces in a cube are equal.

(vii) A cube has twelve vertices.

(viii) Volume of a cube of side 100 cm is 1 m^3.

(ix) An oil tin is of length 30 cm, breadth 30 cm and height 40 cm. If the depth of the oil in the tin is 20 cm, then the oil contained in it is 18 litres.

(x) $1000\ mm^3 = 1\ cm^3$

(xi) $100\ cm^3 = 1\ dm^3$

(xii) $10\ dm^3 = 1\ m^3$

(xiii) $10^6\ cm^3 = 1\ m^3$

(xiv) $1\ ml = 1\ cm^3$

18. Match the items given in Column A with the expressions given in Column B, where l, b, h, etc have their usual meanings:

Column A		*Column B*	
(a)	Volume of a cube	(i)	$\frac{V}{l \times b}$
(b)	Volume of a cuboid	(ii)	l^2
(c)	Area of a face of a cube	(iii)	$\frac{V}{l \times h}$
(d)	Area of four walls of a cuboidal room	(iv)	$2(l \times b + b \times h + h \times$
(e)	Area of all the faces of a cuboid	(v)	$l \times b \times h$
(f)	Area of all the faces of a cube	(vi)	l^3
(g)	Breadth of a cuboid	(vii)	$6l^2$
(h)	Height of a cuboid	(viii)	$2(l + b) \times h$

19. For the cuboid shown in Fig 5.11,

(a) name all the vertices.

(b) name all the edges.

(c) name all the faces.

(d) What is the base of this cuboid ?

(e) What are the lateral faces of this cuboid ?

(f) Name one pair of opposite faces. How many more pairs of opposite faces are there ? Name them.

(g) Name all the faces of this cuboid which have X as a vertex. Also, name those which have VW as a side.

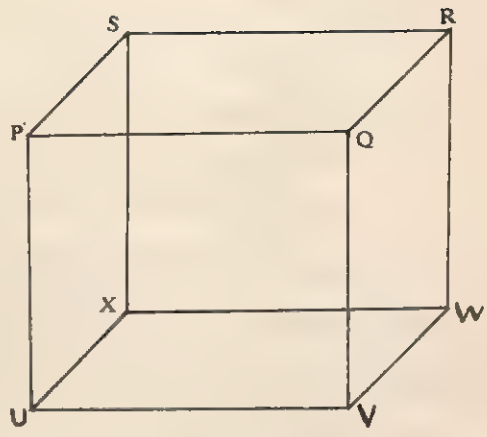


Fig. 5.11

(h) Name those edges of this cuboid which meet at the vertex P. Also, name those faces which meet at this vertex.

20. The dimensions of a cuboid with vertices A,B,C,D,E,F,G and H are as shown in Fig. 5.12.

(a) Which edges are of length 4 cm ? Which edges are of length 5 cm ?

(b) Which faces have area equal to 20 cm^2?

(c) Which faces have the largest area ?

What is this largest area ?

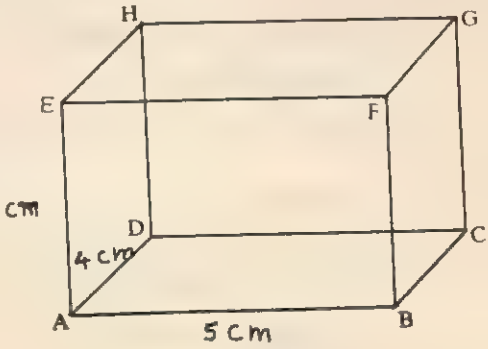


Fig. 5.12

(d) Which faces have a diagonal equal to 5 cm ?

(e) What is the volume of this cuboid ?

(f) What is the surface area of this cuboid ?

(g) What is the area of the base of this cuboid ?

(h) Do all the lateral faces have the same area ?

21. Find the volumes of the cuboids whose dimensions are :

(a) 3 cm, 7 cm, 6 cm

(b) 1 dm, 10 dm, 10 dm

(c) 4 cm, 5 dm, 6 m

(d) 10 mm, 2 cm, .5 dm

(e) 3 m, 30 dm, 300 cm

22. Find the surface area of each of the cuboids in question 21 above :

23. The length, breadth and height of a room are 10 m, 8 m and 6 m respectively. Find the volume of the air contained in the room.

24. A cuboidal box is 5 cm by 5 cm by 4 cm. Find its volume as also its surface area.

25. Find the volume (in m^3) and surface area (in m^2) of a cube of side

(a) 15 cm (b) 7 dm (c) 2.5 m

26. The volume of a cuboidal box is 48 cm^3. If its height and length are 3 cm and 4 cm respectively, find its breadth.

27. What will be the height of a cuboid of volume 168 m^3, if the area of its base is 28 m^2 ?

28. How much clay is dug out in digging a well measuring $3m \times 2m \times 5m$?

29. A cuboidal block of silver is 9 cm long, 4 cm broad and 3.5cm in height. From it, beads of volume 1.5 cm^3 each are to be made. Find the number of beads that can be made from the block.

30. A tank is 8 m long, 6 m broad and 2 m high. How much water can it contain ?

31. Eight identical cuboidal wooden blocks are stacked one on top of the other. The total volume of the solid so obtained is 128 cm^3. If the height of each block is 1 cm and the base is a square, find the dimensions of each block.

32. Find the number of cuboidal boxes measuring 2 cm by 3 cm by 10 cm which can be stored in a carton whose dimensions are 40 cm, 36 cm and 24 cm.

33. A cuboidal block of solid iron has dimensions 50 cm, 45 cm and 34 cm. How many cuboids of size 5 cm by 3 cm by 2 cm can be obtained from this block ? Assume that cutting causes no wastage.

34. Cube A has a side thrice as long as that of cube B. What is the ratio of the volume of cube A to that of cube B ?

35. The capacity of a certain cuboidal tank is 50000 *l* of water. Find the breadth of the tank, if its height and length are 10 m and 2.5m respectively.

36. An 8 m long cuboidal beam of wood when sliced produces four thousand 1-cm cubes and there is no wastage of wood in this process. If one edge of the beam is .5 m, find the third edge.

37. An ice-cream brick measures 20 cm by 10 cm by 7 cm. How many such bricks can be stored in deep fridge whose inner dimensions are 100 cm by 50 cm by 42 cm ?

38. The paint in a certain container is sufficient to paint an area equal to 9.375 m^2. How many bricks measuring 22.5 cm by 10 cm by 7.5 cm can be painted out of this container ?

39. The length, breadth and height of a cuboidal reservoir is 7 m, 6 m and 15 m respectively. 8400 *l* water is pumped out from the reservoir. Find the fall in the water-level in the reservoir.

40. A classroom is 7 m long, 6 m broad and 3.5 m high. Doors and windows occupy an area of 17 m^2. What is the cost of white-washing the walls at the rate of Rs 1.50 per m^2.

41. What will be the labour charges for digging a cuboidal pit 8 m long, 6 m broad and 3 m deep at the rate of Rs 20 per m^3 ?

42. How many planks each of which is 3 m long, 15 cm broad and 5 cm thick can be prepared from a wooden block 6 m long, 75 cm broad and 45 cm thick ?

43. A village, having a population of 4000, requires 150 litres water per head per day. It has a tank which is 20 m long, 15 m broad and 6 m high. For how many days the water of this tank will last ?

44. A rectangular field is 154 m long and 121 m broad. A well of 14 m length and 11 m breadth is dug inside the field and mud taken out is spread evenly over the remaining part of the field to a thickness of 25cm. Find the depth of the well.

45. A water tank built by a municipality of a town to supply water to its 25000 inhabitants at 125 litres per day per person is 40 m long and 31.25 m broad. The tank, when it is full, can supply water for two days to the inhabitants of the town. Find the depth of the tank.

46. A rectangular field is 70 m long and 60 m broad. A well of dimensions 14 m $\times$ 8 m $\times$ 6m is dug outside the field and the earth dug out from this well is spread evenly on the field. How much will the earth level rise ?

47. How many bricks each of size 25 cm $\times$10 cm $\times$ 8 cm will be required to build a wall 5 m long, 3 m high and 16 cm thick, assuming that the volume of sand and cement used in the construction is negligible ?

48. How many bricks of size 22 cm $\times$10 cm $\times$7 cm are required to construct a wall 33 m long, 3.5 m high and 40 cm thick, if cement and sand used in the construction occupy $\frac{1}{10}$ part of the wall ?

49. Length of a classroom is two times its height and its breadth is $1\frac{1}{2}$ times its height. The cost of white-washing the walls at the rate of Rs 1.60 per m^2 is Rs 179.20. Find the cost of tiling the floor at the rate of Rs 6.75 per m^2.

50. The central hall of a school is 80 m long and 8 m high. It has 10 doors each of size 3 m $\times$ 1.5m and 10 windows each of size 1.5 m $\times$ 1 m. If the cost of white-washing the walls of the hall at the rate of Rs 1.20 per m^2 is Rs 2385.60, find the breadth of the hall.

UNIT SIX

Statistics

6.1 Bar Graphs

1. The following data gives the annual growth rates (in per cent) of various five year plans of India :

Plan	*Annual Growth Rate (in per cent)*
First	3.6
Second	4.0
Third	2.2
Fourth	3.3
Fifth	5.1
Sixth	5.3
Seventh	5.0

(i) Represent the above data with the help of a bar graph using a suitable scale.

(ii) Indicate with the help of the bar graph the plan in which the annual growth rate was minimum and the plan in which the annual growth rate was maximum.

(iii) Choose the correct alternative : The consecutive plans in which the increase in annual growth rate is maximum are :

(a) First and Second
(b) Second and Third
(c) Fourth and Fifth
(d) Third and Fourth

2. The following data gives the amount of manure (in thousand tonnes) manufactured by a company during some years :

Year	*Manure (in thousand tonnes)*
1982	15
1983	35
1984	45
1985	30
1986	40
1987	20

(i) Represent the above data with the help of a bar graph.

(ii) Indicate with the help of the bar graph the year in which the amount of manure manufactured by the company was maximum.

(iii) Choose the correct alternative : The consecutive years during which there was maximum decrease in manure production are

(a) 1984 and 1985
(b) 1982 and 1983
(c) 1986 and 1987
(d) 1985 and 1986

3. The following data gives the number of students of the Union Territory of Delhi who went abroad for study during some years :

Year	*Number of Students*
1980	1500
1981	1625
1982	1700
1983	1475
1984	1800

Represent the above data with the help of a bar graph. Is the number of students going abroad from Delhi increasing every year ? Explain your answer with the help of the bar graph.

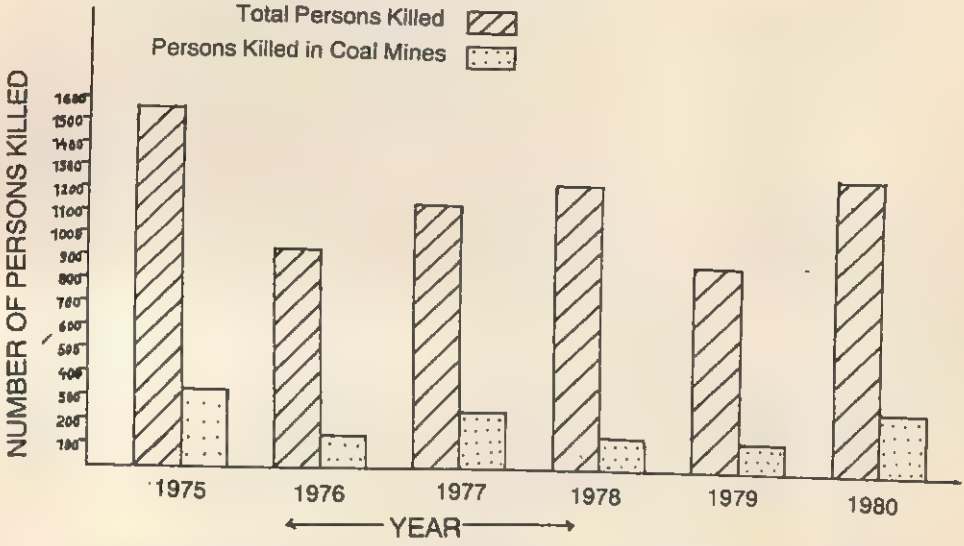


Fig. 6.1 : *Bar graph of the persons killed in industrial accidents in a country for some years*

4. Read the above bar graph and choose the correct alternative in the following :

(i) The year which shows the maximum percentage increase in the number of persons killed in coal mines over the preceding year is

(a) 1976 (b) 1977 (c) 1979 (d) 1980

(ii) The year which shows the maximum decrease in the number of persons killed in industrial accidents over the preceding year is

(a) 1976 (b) 1977 (c) 1978 (d) 1979

(iii) The year in which the maximum number of persons were killed in industrial accidents other than those killed in coal mines is

(a) 1975 (b) 1977 (c) 1978 (d) 1979

5. The following data gives the amount of loans (in crores of rupees) disbursed by a bank during some years :

Year	*Loan (in crores of rupees)*
1982	18
1983	23
1984	45
1985	30
1986	70

(i) Represent the above data with the help of a bar graph.

(ii) With the help of the bar graph, indicate the year in which amount of loan is not increased over that of preceding year.

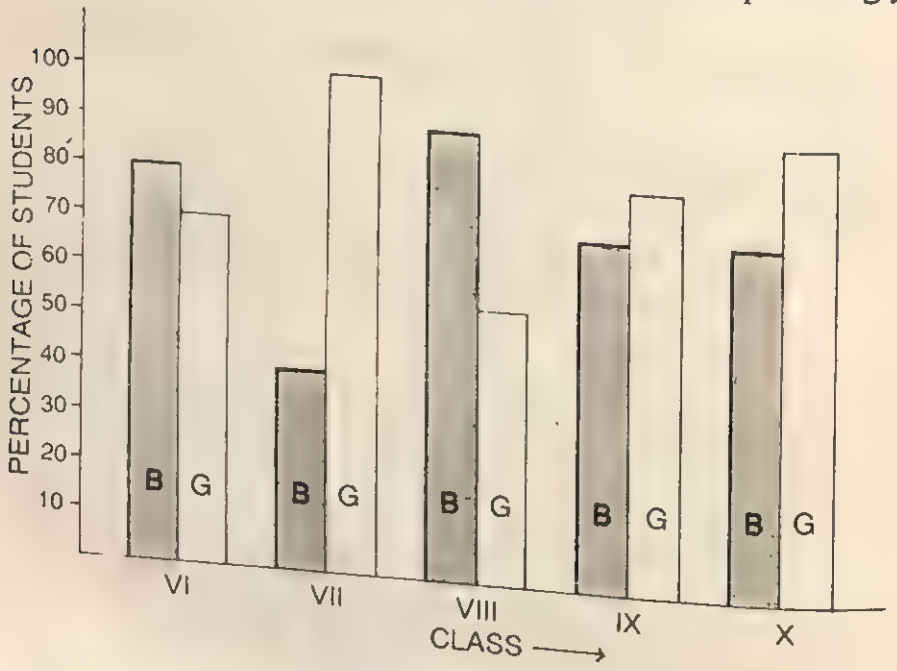


Fig. 6.2 : *Bar graph of the result of an annual examination in a secondary school*

6. Read the bar graph of Fig. 6.2 and choose the correct alternative in the following :

(i) The pair of classes in which the results of boys and girls are inversely proportional are

(a) VI, VIII (b) VI, IX
(c) VIII, IX (d) VIII, X

(ii) The class having the lowest failure rate of girls is

(a) VII (b) X
(c) IX (d) VIII

(iii) The class having the lowest pass rate of students is

(a) VI (b) VII
(c) VIII (d) IX

7. The following data gives the value (in crores of rupees) of the Indian export of cotton textiles for different years :

Year	*Value of Exports of Cotton Textiles (in crores of rupees)*
1982-83	300
1983-84	325
1984-85	475
1985-86	450
1986-87	550

Represent the above data with the help of a bar graph. Indicate with the help of a bar graph the year in which the rate of increase in exports is maximum over the preceding year.

8. The following data gives India's foreign exchange reserves (FER) (in crores of rupees) for some years :

Year	*Foreign Exchange Reserves (in crores of rupees)*
1981-82	4030
1982-83	4780
1983-84	5970
1984-85	7240
1985-86	7420
1986-87	7660

(i) Represent the data with the help of a bar graph.

(ii) With the help of the bar graph, choose the correct alternative: The ratio of the number of years which have below average FER to number of those which have above average FER is

(a) 5 : 1 (b) 1 : 2 (c) 1 : 1 (d) 2 : 1

9. The following data gives the production of foodgrains (in 1000 tonnes) for some years :

Year	*Production of Foodgrains (in 1000 tonnes)*
1982	80
1983	110
1984	100
1985	130
1986	65
1987	120

(i) Represent the above data with the help of a bar graph.

(ii) With the help of the bar graph, choose the correct alternative. The number of years for which the production was below the average production of the given years is

(a) 1 (b) 2 (c) 3 (d) 4

10. The following data gives the demand estimates (of the Government of India – Department of Electronics) for the personnel in the computer sector during the Eigth Plan period (1990-95) :

Qualifications	*Personnel Required*
Master in Computer Application Courses (MCA)	40600
Diploma in Computer Application Courses (DCA)	181600
Diploma in Computer Engineering Courses (DCE)	18600
Certificate Level Courses (CL)	670600
Short Term Courses (ST)	1802900

Represent the data with the help of a bar graph. Indicate with the help of the bar graph the courses where the estimated requirement is least.

UNIT TEST

Arithmetic

Time : 3 hours *Max. Marks* : 100

Marks Allotted

Questions

In questions 1 and 2, four alternatives are given for the answers, out of which only one is correct. Choose the correct answer :

1. The number not equal to $\frac{3}{5}$ is

(a) $\frac{-3}{-5}$ (b) $\frac{-3}{5}$ (c) $\frac{-12}{-20}$ (d) $\frac{30}{50}$ 2

2. $\left(-\frac{2}{5}\right)^7 + \left(-\frac{2}{5}\right)^3$ is equal to

(a) $\left(\frac{2}{5}\right)^4$ (b) $\left(-\frac{2}{5}\right)^3$ (c) $\left(\frac{2}{5}\right)^3$ (d) $-\left(\frac{2}{5}\right)^4$ 2

3. Fill in the blanks so as to make the statement true :

(i) The two consecutive integers between which $\frac{-12}{5}$ lies are _____ and _____. 2

(ii) The reciprocal of $\left(\frac{-2}{3}\right)^4$ is _____. 2

4. State whether the following statement is true (T) or false (F) :

   (i) The product of a rational number and its reciprocal is 1. 2

   (ii) If a rational number $\frac{p}{x}$ is less than a rational number $\frac{p}{x}$ then x is less than y, provided p, x and y are all positive. 2

5. Write the number $\frac{27}{-12}$ in the standard form. 4

6. Insert any two rational numbers between $\frac{4}{-9}$ and $\frac{3}{-4}$. 4

7. Subtract $\frac{4}{3}$ from $\frac{-7}{6}$. 4

8. The product of two rational numbers is $\frac{13}{12}$. If one of the numbers is $\frac{-5}{18}$, find the other. 4

9. Find all rational numbers whose absolute value is less than $\frac{2}{5}$. 4

10. Find the value of $\left(-\frac{1}{5}\right)^{3\times 5-15}$ 4

11. Express $\left[\left(-\frac{2}{3}\right)^{3}\right]^{-2}$ as a rational number with positive exponent. 4

12. Write 0.0000000135 using scientific notation. 4

13. Express $\frac{117}{10}$ as a terminating as well as a non-terminating decimal. The non-terminating representation should not end in a sequence of zeros. 7

14. Write $\frac{2}{5}$ in a form so that the numerator may be equal to -550. 7

15. Arrange the following numbers in ascending order : 7

$$\frac{2}{3}, \frac{4}{5}, \frac{-4}{5}, \frac{3}{4}, \frac{-3}{4}, \frac{7}{-8}, \frac{5}{-6}$$

16. Simplify : 7

$$\left(\frac{-7}{15} \times \frac{18}{-7}\right) - \left(\frac{1}{2} \times \frac{2}{3}\right) + \left(\frac{2}{3} \times \frac{9}{4}\right)$$

17. Simplify the following and express the result as a power 3 : 7

$$\left[\left(\frac{2}{3}\right)^{-3} \times \left(\frac{2}{3}\right)^{11}\right] \div \left(\frac{2}{3}\right)^{8}$$

18. By what number should $\left(\frac{-7}{2}\right)^{-4}$ be divided so that the quotient may be $\frac{49}{8}$? 7

19. Express 9.98 as a rational number in its lowest terms. 7

20. Convert $1.\overline{35}$ in the $\frac{p}{q}$ form. 7

UNIT TEST

Algebra

Time : 3 hours

Max. Marks : 100

Marks Allotted

Questions

In questions 1 and 2, four alternatives are given for the answer, out of which only one is correct. Choose the correct answer :

1. The value of the expression $5x^2 - 7x + 4$ for $x = 1$ is

(a) $511 - 71 + 4$ (b) -2

(c) 2 (d) $51^2 - 7 + 4$ **2**

2. The G.C.F. of $36x^2yz^3$ and $24xy^2z^2$ is

(a) xyz (b) $12xyz$

(c) $12 \times 3 \times 2xyz^2$ (d) $12xyz^2$ **2**

3. Fill in the blanks so as to make the statement true :

(i) $(a - b)^2 = a^2 - \_\_\_\_\_ + b^2$ **2**

(ii) The variable part in the _____ of two monomials is equal to the product of the _____ parts in the given monomials. **2**

4. State whether the following statement is true (T) or false (F) :

(i) The G.C.F. of $42\ x^2\ y\ z^3$ and $7\ x\ y^2\ z^2$ is $7\ x\ y^2\ z^2$. **2**

(ii) The solution of the equation $5\ x + 9 = 0$ is $-\frac{9}{5}$. **2**

5. Find the value of $2ax^2 - 5a^2x^2 + 3$ for $a = 2$ and $x = -3$. **4**

6. Find the product of $5ax$ and $-3by$. 4

7. Multiply the monomials $-6x^2$, $-\frac{1}{3}z$ and $12x^2y^3z$. 4

8. Simplify : $(x + 2y)(x - 2y) + x^2 + 4y^2$ 4

9. Using a suitable identity, write the product of $(3x + 7y)$ and $(3x + 7y)$. 4

10. Find the value of 88×112, using a suitable identity. 4

11. Find the value of 801^2, using a suitable identity. 4

12. Factorize $15xy - 10y^2$. 4

13. Find the solution of the equation

$$\frac{1}{2}x + 7x - 6 = 7x + \frac{1}{4}.$$ 7

14. A number is multiplied by 13 and then added to 56. The result is 160. Find the number. 7

15. Express $4x^2 + 2xy + \frac{1}{4}y^2$ as a product of two binomials. 7

16. Factorize completely the expression $81x^4 - 16$. 7

17. Find the G.C.F. of $ax + ay + bx + by$ and $a^2 - b^2$. 7

18. Factorize $x^8 - 2x^4y^4 + y^8 + x^4 - y^4$. 7

19. Write the equation $-11x + \left(\frac{2}{3}x + 3\right) = 2\left(\frac{x}{3} + 1\right)$ in the form $ax + b = 0$. 7

20. The length of a rectangle is 20 cm more than its breadth. If its perimeter is 100 cm, find the length and breadth of the rectangle. 7

UNIT TEST

Commercial Mathematics and Statistics

Time : 3 hours

Max. Marks : 100

Marks Allotted

Questions

In questions 1 and 2, four alternatives are given for the answers,out of which only one is correct. Choose the correct answer :

1. x and y vary inversely with each other. When x is 12, y is 9. The pair which is not a possible pair of corresponding values of x and y is

   (a) 9 and 12 (b) 18 and 6

   (c) 24 and 18 (d) 36 and 3 **2**

2. If marked price of an article is Rs 1200 and the discount is 12%, then the selling price of the article is

   (a) Rs 1056 (b) Rs 1344

   (c) Rs 1212 (d) Rs 1188 **2**

3. Fill in the blanks so as to make the statement true :

   (i) If x = 5y, then x and y vary_____with each other. **2**

   (ii) In case of loss, S.P = (100 – _____ %) × C.P. **2**

4. State whether the following statement is true (T) or false (F) :

(i) Speed = Distance × Time 2

(ii) 100 % of 200 is 200. 2

5. If the cost of 90 m of a certain kind of plastic sheet is Rs 1350, find the cost of 112 m of such plastic sheet. 4

6. If 15 labourers can build a house in 200 days, in how many days would 16 labourers be able to build the same house ? 4

7. A bullock-cart covers a distance of 26 km in five hours. Find the average speed of the cart. 4

8. Nita obtained 72% marks in an examination. If she obtained 576 marks in the examination, find the total marks of the examination. 4

9. An alloy of zinc and copper consists of 21 parts of zinc and 59 parts of copper. Find the percentage of zinc in the alloy. 4

10. Find the C.P. of an article which when sold at Rs 300 brings a profit of 20%. 4

11. At what rate per cent per annum will Rs 1200 produce Rs 600 as interest in 5 years ? 4

12. A train, 77 m long, is running at 60 km/hr. If it takes 30 seconds to cross a bridge, find the length of the bridge. 4

13. A and B can do a piece of work in 10 days, B and C can do the same work in 15 days and C and A can do it in 20 days. In how many days can A alone do the same work ? 7

14. A garden has 6000 trees. 5% of the trees are mango trees and 2% are orange trees. Find the number of other trees in the garden. 7

15. A shopkeeper buys pens at the rate of Rs 75 per 100. For how much should he sell each pen so as to make a gain of 15% ? 7

16. A shopkeeper offers 3% discount on all his goods. He offers a further discount of 1% on the reduced price to those who pay cash. If the marked price of an article is Rs 4200, what amount will I have to pay for that article in cash ? 7

17. Find principal, when simple interest = Rs 140, rate = 16% per annum and time = $2\frac{1}{2}$ years. 7

18. The cost price of 15 apples is equal to selling price of 12 apples. Find the gain or loss in the transaction. 7

19. A shopkeeper allows a 5% off on the marked price of goods to his customers and still earns a profit of $16\frac{2}{3}\%$. Find the actual cost price for the shopkeeper of an article marked Rs 400 . 7

20. The following data gives the number of industrial sick units in various years :

Year	*Number of Industrial Sick Units (in thousands)*
1980	24
1981	30
1982	60
1983	80
1984	90

Draw a bar graph to represent the above data. State with the help of the bar graph whether the number of industrial sick units is increasing every year. 7

UNIT TEST.

Geometry

Time : 3 hours *Max. Marks : 100*

Marks allotted

Questions

In questions 1 and 2, four alternatives are given for the answers, out of which only one is correct. Choose the correct answer :

1. In ΔABC, if $BC = AB$, $\angle B = 80^\circ$, then $\angle C$ equals

(a) 80° (b) 20°

(c) 100° (d) 50° 2

2. A diagonal of a rectangle is inclined at an angle of 25° to one side of the rectangle. The obtuse angle between the diagonals is

(a) 155° (b) 130°

(c) 125° (d) 140° 2

3. Fill in the blanks so as to make the statement true :

(i) A diameter of a circle is the _____ chord of the circle. 2

(ii) The point common to all the angle bisectors of a triangle is called its _____ . 2

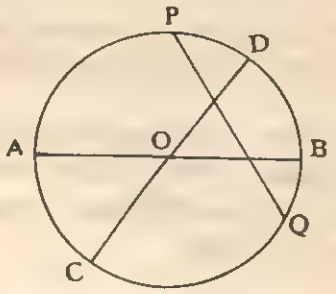
4. State whether the given statement is true (T) or false (F) :

(i) The ortho-centre of a triangle always lies in the interior of the triangle. **2**

(ii) The diagonals of a rectangle are perpendicular to each other. **2**

5. Angles of a triangle are in the ratio 2 : 3 : 4 . Find the angles of the triangle. **4**

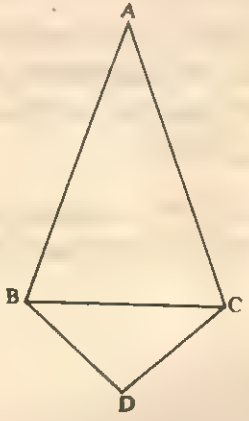
6. In the adjoining figure, AB and CD are diameters of a circle and PQ is a chord. Name all the minor arcs of the circle . Also name the centre of the circle. **4**



7. Draw a line-segment AB of any length. Using ruler and compass, draw another line-segment CD such that $CD = \frac{3}{2} AB$. **4**

8. Draw a right triangle whose hypotenuse is of length 5 cm and one of the sides is 2 cm. **4**

9. If AL is an altitude of a triangle ABC, show that $AB + AC > 2AL$. **4**



10. In the adjoining figure, ABC and DBC are two isosceles triangles such that $\angle A = 40^\circ$ and $\angle D = 100^\circ$. Find $\angle ABD$. **4**

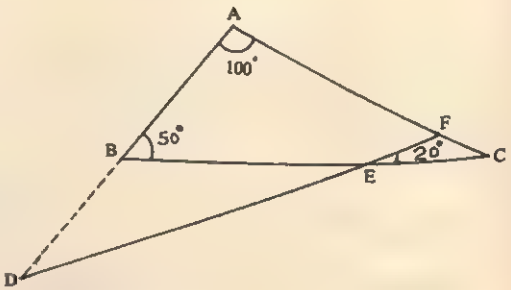
11. ABC is an isosceles triangle with AB = AC. BE and CF are the bisectors of $\angle$ B and $\angle$ C respectively.

(i) Is $\Delta BCE \cong \Delta CBF$? Give reasons.
(ii) Is BF = CF ? Give reasons. 4

12. A pair of two adjacent angles of a parallelogram are in the ratio 4 : 5. Find the measure of each angle of the parallelogram. 4

13. The bisectors of exterior angles at B and C of ΔABC meet at O. If $\angle A = 40^\circ$, find $\angle BOC$. 7

14. In the adjoining figure, if $\angle BAC = 100^\circ$, $\angle ABC = 50^\circ$, $\angle FEC = 20^\circ$, find $\angle AFE$ and $\angle BDE$. 7



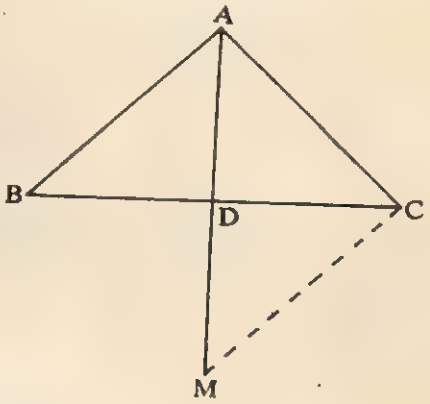
15. Given a circle with centre O and radius 3 cm, what is the length of the longest chord of the circle. 7

16. Draw an angle BAC of measure 60° and take a point P in its interior. Through P, draw rays respectively parallel to rays AB and AC intersecting AC in E and AB in F. Measure $\angle EPF$. 7

17. X and Y are respectively the mid-points of the sides AB and BC of a parallelogram ABCD. DX and DY intersect the diagonal AC at M and N respectively . If AC = 8 cm, find XY and MN. 7

18. ABCD is a square and P is any point on one of its diagonals BD. Is $\Delta ABP \cong \Delta CBP$? Give reasons. 7

19. In the adjoining figure, median AD of ΔABC is produced to a point M such that AD = DM.



(i) Is $\Delta ABD \cong \Delta MCD$?
Give reasons.

(ii) Is AB + AC > 2 AD ?
Give reasons. **7**

20. The angles of a quadrilateral are in the ratio 1 : 2 : 7 : 8 . Find the angles of the quadrilateral. What type of a quadrilateral is it ? **7**

UNIT TEST

Mensuration

Time : 3 hours

Max. Marks : 100

Marks Allotted

Questions

In questions 1 and 2, four alternatives are given for the answers, out of which only one is correct. Choose the correct answer :

1. One square decimetre is not equal to

(a) $\frac{1}{100}\,m^2$ (b) $\frac{1}{100}\,dam^2$

(c) $\frac{1}{1000}$ *are* (d) $\frac{1}{1000000}$ ha 2

2. The length, breadth and height of a cuboid (in cm) are 5, 3 and 2 respectively. The surface area of the cuboid (in cm^2) is

(a) 20 (b) 100

(c) 62 (d) 31 2

3. Fill in the blanks so as to make the statement true :

(i) $1\ cm^2 =$ _____ mm^2. 2

(ii) _____ edges of a cuboid meet at each of its vertices. 2

4. State whether the given statement is true (T) or false (F) :

(i) If each side of a square is doubled, then the area of the new square will be two times the area of the original square. 2

(ii) $10^6\ cm^3 = 1\ m^3$ 2

5.	Find the area (in cm^2) of a rectangle whose length and breadth are respectively 75 mm and 2 cm.	**4**
6.	What would happen to the area of a rectangle, if its length is halved and the breadth is doubled ?	**4**
7.	The area of a rectangular field is 105 m^2. If its length is 15 m, find its breadth.	**4**
8.	A wall can be covered by 2400 tiles of size 25 cm by 20 cm. If the length of the wall is 4 m, find its height.	**4**
9.	Find the volume of a cuboid (in cm^3) whose dimensions are 1dm × 10dm × 2m .	**4**
10.	Find the surface area of a cube of side 11 m.	**4**
11.	The volume of a cuboidal box is 96 cm^3. If its length and breadth are 8 cm and 4 cm respectively, find its height.	**4**
12.	Find the volume (in cm^3) of a cube of side 2 dm.	**4**
13.	The perimeter of a rectangular field is equal to the perimeter of a square field. If the length and breadth of the rectangular field are respectively 120 m and 25 m, find the area of the square field.	**7**
14.	Along the four sides of a rectangular field, a path of 7m width is constructed outside the field. If the dimensions of the field are 83 m by 43 m, find the area of the path.	**7**
15.	There is a rectangular field of size 90 m by 35 m. Three roads each of width 3 m pass through the field such that two roads are parallel to the length and the third is parallel to the breadth and cuts the other two roads . Find the area of the part of field not covered by the roads.	**7**
16.	Find the area of a rhombus whose diagonals are 12 cm and 60mm.	**7**
17.	If the rain fall on a certain day on a certain field of area 40 ha was 2 cm, then how many litres of water fell on the field that day ?	**7**

18. Seven identical cuboidal blocks are stacked one on top of the other. The volume of the solid so obtained is 112 cm^3. If the height of each block is 1 cm and the base is a square, find the dimensions of each block. 7

19. How many cuboids of size 4 cm by 3 cm by 2 cm can be placed in a cuboidal box of size 40 cm by 24 cm by 22 cm ? 7

20. The capacity of a certain cuboidal water tank is 450000 *l*. If the height and length of the tank are 12 m and 5 m, find its breadth. 7

Some Interesting Problems

1. Is $a \div b = b \div a$ for all rational numbers ? If your answer is 'no', then try with some values of a and b for which the answer is 'yes'.

2. What do the following numbers remind us ?

   (a) 180 (b) 90

   (c) 3 (d) 4

   (e) 6 (f) 12

   (g) 3,4,5 (h) 5,12,13

   (i) 36, 10 (j) 1000

3. Write hundred by using

   (a) four nines. (Fractions are allowed but no operations are allowed.)

   (b) all the digits 0, 1, 2, . . ., 8, 9 exactly once. (Operations are allowed).

4. Write suitable digits in place of stars (★) in the following so that each statment is true :

   (a) $5x - 3 = ★\, x + 7$

   or, $x = 10$

   (b) $(m^2 - n^2)^2 + (★mn)^2 = (m^2 + n^2)^2$

5. Simplify $\left[\left(\frac{1}{4}\right)^3 \times \left(\frac{1}{4}\right)^8\right] \div \left(\frac{1}{4}\right)^{11}$ and express the result as a power of 5.

6. If 5 girls wrap 5 gift packets in 5 minutes, then how many girls will wrap 50 gift packets in 50 minutes ?

7. Let $P = AQ - 4$. It is given that when $Q = 8$, $P = 16$. Find P, when $Q = 10$.

8. There are 1089 students in a school. One-ninth of the students wear exactly one glove and half of the others just do not wear gloves. How many gloves are being used by the students ?

9. A can is $\frac{1}{4}$ th full with water. The water is poured into another can. This can gets $\frac{3}{5}$ th full with water. What is the ratio of the capacity of the first can to that of the second ?

10. Digit 1 is placed after a two-digit number whose ten's digit is t and unit's digit is u. Find the value of the new number.

11. x is a digit such that when x 59 is subtracted from 95 x, then the resulting number again consists of the digits x, 5 and 9 only in some order. Find x.

12. *A Chinese Problem of about First A.D.* : In a certain party, there was a bowl of rice for every two guests, a bowl of broth for every three of them and a bowl of meat for every four of them. If in all, there were 65 bowls of food, then how many guests were there in the party ?

13. Kamla, Vimla and Nirmala started a business. Vimla invested thrice as much as Nirmala. Kamla contributed the rest and it was $\frac{3}{7}$th of the total capital. What fraction of the total capital was invested by Nirmala ?

14. A shopkeeper allows a discount of 10% on his goods. For cash payment, he further allows a discount of 20% . Find a single discount equivalent to the above offer.

15. Find the volume of a cuboid the surface areas of whose side, front and bottom faces are respectively 12 cm^2, 8 cm^2 and 6 cm^2.

16. A car travels a distance of 120 km from place A to place B at a speed of 30 km/hour but returns back the same distance at 40 km/hour. Find the average speed of the car in the whole trip.

17. A shopkeeper buys goods at 25% of the list price. He desires to mark the goods so that he can give a discount of 20% on the marked price and still earns a profit of 25% . What per cent of the list price must he mark the goods ?

18. A purchases a house for Rs 100000. He sells it to B at 10% profit. B sells the house back to A at 10% loss. What is the profit or loss of A ?

19. In which of the following equations y is neither directly nor inversely proportional to x ?

(i) $x + 2y = 0$

(ii) $2x = 5y$

(iii) $5x + 3y = 7$

(iv) $5xy = 9$

(v) $2x - 3y = -5$

(vi) $x - 5y = 0$

20. The price of sugar is increased by 20% . By what per cent should a family decrease the consumption of sugar so that there is no change in their expenditure for sugar ?

21. A reduction in the price of cashew nuts by 10% enables a person to buy 3 kg of cashew nuts more for Rs 1971. Find the reduced price and the original price per kg of cashew nuts.

22. Nazima ordered 4 pairs of white socks and some additional pairs of blue socks . The price of white socks per pair was twice that of the blue socks. When the order was filled, it was found that the number of pairs of the two colours had been interchanged. This increased the bill by 50% . Find the ratio of the number of pairs of white socks to that of the pairs of blue socks in the original order placed by Nazima.

23. Find the area of a square, the length of whose diagonal is (a + b) cm .

24. The sides of a triangle are in the ratio 6 : 8 : 9 . Is the triangle acute, obtuse or right ?

25. A rectangle inscribed in a triangle has its base coinciding with the base b of the triangle . If the corresponding altitude of the triangle is h and

that of the rectangle is half of the base of the rectangle, find the altitude of the rectangle in terms of b and h .

26. Pipes A and B can fill a tank in 5 and 6 hours respectively. Pipe C can empty it in 12 hours. The tank is half full. All three pipes are in operation simultaneously. Will the tank be ever full ? If yes, after how much time ?

27. Can you describe a square in a circle so that all the vertices of the square lie on the circle ? If yes, then where will the diagonals of such a square be ? If the radius of the circle be 1 cm, then what would be the square of the side of the square ?

28. A boy buys oranges at 3 for Rs 10 . He will sell them at 5 for Rs 20. How many oranges must he sell to earn a profit of Rs 100 ?

29. A woman invests a part of Rs 4500 at 4% and rest at 6% per annum. If her annual return on each investment is the same, find the overall rate of interest that she realizes on Rs 4500 .

30. A girl's camp is located at a distance of 300 m from a straight road. On this road, a boys' camp is located at a distance of 500 m from the girls' camp. It is desired to build a canteen on the road which shall be equidistant from each camp. Find the distance of the canteen from each camp.

31. The base of a triangle is twice as long as a side of a square and their areas are equal. Find the ratio of the corresponding altitude of the triangle to the side of the square.

32. If the ratio of the legs of a right triangle is 1 : 2, find the ratio of the corresponding parts of the hypotenuse made by a perpendicular upon it from the opposite vertex.

33. In a group of cows and hens, the number of legs was 14 more than twice the number of heads. Find the number of cows in the group. Can you also find the number of hens ?

34. Find the number of scalene triangles having all sides of integral lengths (in cm) and perimeter less than 13 cm.

35. Find the number of distinct lines representing altitudes, medians and angle bisectors of an isosceles triangle but not equilateral.

36. Each edge of a cube is increased by 50% . Find the per cent increase in the surface area of the cube.

37. AE, BF and CD are medians of ΔABC and FH is drawn parallel and equal to AE . FE produced meets BH in G. Which one of the following is not necessarily true ?

(i) AFHE is a parallelogram.

(ii) BH = DC

(iii) HE = HG

(iv) $FG = \frac{3}{4}$ AB

(v) FG is a median of ΔBFH

38. E,F,G and H lie on sides BC, CD, DA and AB respectively of a rectangle ABCD such that AE is a trisector of $\angle A$, BF is a trisector of $\angle B$, CG is a trisector of $\angle C$ and DH is a trisector of $\angle D$. AE intersects DH and BF at P and Q respectively and CG intersects BH and BF at S and R respectively. What type of a figure is PQRS ?

39. A 5-cm cube painted on all sides is sliced into small 1-cm cubes. How many of the small cubes would have exactly

(a) 3 painted faces ?

(b) 2 painted faces ?

(c) 1 painted face ?

(d) no painted face ?

40. A 4 cm $\times$ 6 cm $\times$ 8 cm cuboid, painted on all sides, is cut off into 2 cm cubes. How many small cubes would be there ? How many of these would have exactly

(a) 3 painted faces ?

(b) 2 painted faces ?

(c) 1 painted face ?

(d) no painted face ?

41. One pair of opposite faces of an 8 cm-cube is painted blue, the other two pairs of opposite faces being green and red respectively. The cube

is now sliced off into 1-cm cubes. How many of these small cubes would have

(a) no painted face ?

(b) one red, one blue and one green face ?

(c) exactly one red and one blue face, the others being unpainted?

(d) exactly one green and one red face, the others being unpainted?

(e) exactly one blue and one green face, the others being unpainted ?

(f) one red and five unpainted faces ?

(g) one green and five unpainted faces ?

(h) two faces painted in the same colour ?

42. The dimensions of a room are $5\text{ m} \times 4\text{ m} \times 3\text{ m}$. What is the area of the square with side as the length of a longest pole that can be placed in the room ?

43. The medians of a right triangle are drawn from the vertices of the acute angles. If the areas of the square with these medians as sides are 25 cm^2 and 40 cm^2 respectively, find the area of the square with hypotenuse of the right triangle as the side.

ANSWERS

UNIT ONE

Arithmetic

1.1 Rational Numbers

1. (b) **2.** (d) **3.** (d) **4.** (b) **5.** (c)
6. (c) **7.** (b) **8.** (a) **9.** (c) **10.** (b)

11. (a) rational number (b) standard form
(c) standard (d) a number line (e) $y \div m$
(f) negative (g) (i) $x = 0$ (ii) $x < 0$ (h) $x > z$
(i) greater than (j) less than

12. (a) 1, –5 (b) 3, –9 (c) 0, 0 (d) –2, 2 (e) –3
(f) –4 (g) –25 (h) –18

13. (a) < (b) > (c) > (d) >

14. (a) $\frac{-1}{1}$ (b) as many (c) as many (d) zero (e) $\frac{13}{5}$ (f) $\frac{3}{5}$ (g) ratio

15. (a) $x > z$ (b) x and z cannot be compared (c) $x < z$ (d) x and z cannot be compared

16. (i) F (ii) F (iii) T (iv) T (v) F (vi) T
(vii) F (viii) F (ix) F (x) F (xi) F (xii) T

17. $\frac{9}{3}$, $\frac{6}{3}$, $\frac{4}{2}$, $\frac{3}{1}$, $\frac{2}{1}$, $\frac{1}{1}$, $\frac{0}{1}$, $\frac{-1}{1}$, $\frac{-2}{1}$, $\frac{-4}{2}$

18. $\frac{-3}{4}$, $\frac{4}{-5}$, $\frac{-6}{7}$ **19.** $\frac{64}{16}$, $\frac{36}{-12}$, $\frac{5}{-4}$, $\frac{140}{28}$

20. $\frac{1}{22}, \frac{2}{3}, \frac{3}{4}, \frac{-6}{7}$ **21.** $\frac{-2}{6}, \frac{7}{-21}, \frac{42}{-126}, \frac{-70}{210}$

22. $\frac{3}{7}, \frac{8}{11}$ **23.** $\frac{35}{8}, \frac{61}{8}, \frac{-71}{8}, \frac{-28}{3}, \frac{-23}{11}, \frac{-17}{23}$

24. $8\frac{3}{4}, 5\frac{3}{6}, 9\frac{2}{5}, 16\frac{1}{8}, -7\frac{2}{13}, -10\frac{3}{5}$

26. 8 and 9, 5 and 6, 9 and 10, 16 and 17, –8 and –7, –11 and –10

27. $\frac{5}{20}, \frac{9}{36}, \frac{11}{44}, \frac{-20}{-80}, \frac{-25}{-100}, \frac{10000}{40000}$

28. $\frac{-56}{140}, \frac{154}{385}, \frac{-750}{-1875}, \frac{500}{1250}, \frac{6250}{15625}$

29. $\frac{1}{5}, \frac{-1}{5}, \frac{-1}{4}, \frac{1}{4}, \frac{3}{7}, \frac{3}{8}, \frac{3}{10}$

30. (a) $\frac{2}{3}$ (b) $\frac{4}{12}$ (c) $\frac{-8}{13}$ (d) $\frac{-4}{-8}$

31. (a) 5 (b) –4 (c) $\frac{9}{-4}$ (d) $\frac{789}{100}$

32. $\frac{-4}{16}, \frac{-3}{15}, \frac{2}{10}, \frac{7}{28}, \frac{63}{210}, \frac{24}{64}, \frac{15}{35}$

33. $\frac{5}{6}, \frac{3}{4}, \frac{2}{3}, \frac{1}{22}, \frac{-4}{5}, \frac{-6}{7}, \frac{-7}{8}$

1.2 Operations on Rational Numbers

1. (b) **2.** (c) **3.** (a) **4.** (c) **5.** (b)

6. (b) **7.** (d) **8.** (a) $\frac{4}{5}, \frac{-2}{5}$ (b) $\frac{-5}{6}$ (c) $\frac{7}{-9}$

(d) $\frac{-5}{7}$ **9.** (a) y, z (b) x (c) x (d) x

10. (a) $\frac{3}{8}$ (b) $\frac{-1}{8}$ (c) $\frac{2}{7}$ (d) $\frac{-2}{9}$ (e) –y

(f) $\frac{3}{5}, \frac{1}{3}$ (g) $\frac{6}{7}$ (h) $\frac{-3}{4}$ (i) 0 (j) $\frac{5}{7}, \frac{2}{5}$

(k) 0 (l) x (m) $x \times y, x \times z$

11. (a) $\frac{3}{2}$ (b) $\frac{7}{-5}$ (c) $\frac{4}{-1}$ (d) $\frac{1}{-2}$

12. (a) $\frac{3}{-2}$ (b) 1 (c) -1 (d) $\frac{-2}{3}$ (e) -1

(f) $\frac{7}{8}$ (g) $\frac{23}{29}$ (h) $<$ (i) $=$ (j) $=$

(k) $\frac{5}{8}$ (l) $=$ (m) $\frac{2}{9}$ (n) $\frac{7}{6}$ (o) 0

(p) $\times$ (q) 1 (r) -1 (s) $\leq$ (t) $=$

13. (a) $\frac{11}{8}$ (b) $\frac{39}{8}$ (c) $\frac{-52}{11}$ (d) $\frac{13}{14}$ (e) $\frac{-1}{2}$

(f) $\frac{-2}{9}$ (g) $\frac{3}{7}$

14. (i) F (ii) T (iii) F (iv) F (v) T
(vi) T (vii) T (viii) F (ix) F (x) F
(xi) T (xii) F (xiii) F (xiv) F (xv) F
(xvi) T (xvii) T (xviii) F (xix) F (xx) F
(xxi) F (xxii) T (xxiii) T (xxiv) T (xxv) F
(xxvi) F (xxvii) T

15. (i) T (ii) T (iii) F (iv) F (v) F
(vi) T (vii) F (viii) T (ix) F (x) F
(xi) T (xii) T (xiii) T (xiv) T (xv) F
(xvi) T (xvii) T (xviii) F (xix) T (xx) F
(xxi) T (xxii) T

16. (a) 1 (b) $\frac{-9}{5}$ (c) $\frac{-5}{8}$ (d) $\frac{1}{36}$

17. (a) $\frac{2}{3}$ (b) $\frac{3}{2}$ (c) $\frac{-2}{3}$ (d) $\frac{43}{42}$

18. (a) $1\frac{9}{10}$ (b) $2\frac{9}{14}$ (c) $-8\frac{13}{24}$ (d) $17\frac{17}{24}$

19. (a) $\frac{17}{24}$ (b) $\frac{-17}{18}$ (c) $\frac{-119}{24}$ (d) $\frac{-61}{30}$

20. (a) -1 (b) $\frac{-35}{8}$ (c) $\frac{-47}{4}$ (d) $\frac{-77}{18}$

21. (a) $\frac{23}{15}$ (b) $\frac{-11}{63}$ (c) $\frac{235}{24}$ (d) $\frac{11}{10}$

22. (a) $\frac{5}{3}$ (b) $\frac{-13}{6}$ (c) $\frac{35}{8}$ (d) $\frac{13}{10}$

23. (a) $\frac{-2}{3}$, $\frac{-11}{17}$, $\frac{-6}{1}$, $\frac{-105}{253}$ (b) $\frac{2}{5}$, $\frac{7}{9}$, $\frac{16}{13}$, $\frac{5}{1}$

(c) 0, -1, 1

24. (a) $\frac{7}{2}$ (b) $\frac{31}{12}$ (c) $\frac{-31}{18}$ (d) $\frac{-9}{22}$

(e) $\frac{17}{21}$ (f) $\frac{45}{8}$ (g) $\frac{25}{7}$ (h) $\frac{14}{9}$

25. (a) -2 (b) $\frac{-1}{6}$ (c) $\frac{3}{4}$ (d) $\frac{33}{70}$

26. (a) $\frac{16}{3}$ (b) $\frac{-22}{3}$ (c) 30 (d) -25

27. (a) $\frac{7}{12}$ (b) $\frac{-14}{45}$ (c) $\frac{-2}{3}$ (d) $\frac{1}{7}$

28. (a) $\frac{-3}{4}$ (b) $\frac{-39}{7}$ (c) $\frac{-5}{4}$ (d) $\frac{-2}{3}$

(e) $\frac{-17}{18}$ (f) 0

29. (a) $\frac{7}{9}$ (b) $\frac{-8}{15}$ (c) $\frac{-51}{2}$ (d) $\frac{-30}{1}$

30. (a) 2 (b) -7 (c) $\frac{4}{3}$ (d) $\frac{-2}{3}$

(e) $\frac{-7}{4}$ (f) 0

31. (a) $\frac{5}{13}$ (b) $\frac{-8}{7}$ (c) $\frac{51}{4}$ (d) $\frac{-2}{99}$

(e) $\frac{2}{15}$ (f) $\frac{36}{5}$

32. $\frac{1}{2}$, 5, 0, $\frac{3}{7}$, $\frac{6}{5}$, $\frac{3}{4}$, $\frac{3}{5}$, $\frac{17}{8}$

33. (a) $\frac{1}{2}$ and $\frac{-1}{2}$ (b) 0

34. (a) x is a rational number such that $-4 < x < 4$

(b) x is a rational number such that $\frac{-1}{4} < x < \frac{1}{4}$

37. $\frac{-35}{6}$ **38.** $\frac{-1}{16}$ **39.** $\frac{7}{32}$ **40.** $\frac{11}{9}$

41. (a) $\frac{25}{8}$ (b) $\frac{2}{3}$ (c) $\frac{17}{24}$

45. (a) $\frac{55}{8}$ (b) $\frac{-10}{3}$ (c) $\frac{-11}{8}$ (d) $\frac{-88}{3}$

46. $\frac{-3}{2}$ **47.** $\frac{26}{15}$ **48.** $\frac{46}{3}$ **49.** $\frac{-8}{9}$

50. (a) $\frac{20}{33}$ (b) $\frac{2}{7}$ (c) $\frac{-16}{3}$ (d) $\frac{7}{12}$

1.3 Exponents

1. (d)	**2.** (c)	**3.** (c)	**4.** (a)	**5.** (c)
6. (b)	**7.** (a)	**8.** (c)	**9.** (c)	**10.** (b)
11. (c)	**12.** (d)	**13.** (a)	**14.** (b)	**15.** (a)
16. (b)	**17.** (c)	**18.** (b)	**19.** (c)	**20.** (b)

21. (c)

22. (a) 24 (b) 44 (c) 65 (d) 11 (e) 2 (f) 7 (g) $\frac{1}{2}$ (h) 8 (i) $\frac{13}{14}$ (j) 7 (k) 6 (l) 64

23. (i) F (ii) T (iii) F (iv) F (v) T (vi) F (vii) T (viii) F (ix) T (x) T

24. (a) $\frac{9}{49}$ (b) $\frac{343}{729}$ (c) $\frac{4}{9}$ (d) $\frac{-27}{125}$

25. (a) $\left(\frac{2}{3}\right)^3$ (b) $\left(\frac{4}{3}\right)^5$ (c) $\left(\frac{-5}{2}\right)^4$ (d) $\left(\frac{-10}{3}\right)^6$

26. (a) $\frac{1}{256}$ (b) $\frac{375}{112}$ (c) $\frac{-640}{81}$ (d) $\frac{225}{16}$

27. (a) $\left(\frac{7}{8}\right)^2$ (b) $\left(\frac{3}{5}\right)^2$ (c) $\left(\frac{3}{4}\right)^3$ (d) $\left(\frac{4}{5}\right)^3$

(e) $\left(\frac{-3}{2}\right)^3$ (f) $\left(\frac{-1}{6}\right)^3$

28. (a) $-\frac{1}{8}$ (b) $-\frac{1}{8}$

29. (a) $\left(\frac{-1}{5}\right)^3$ (b) $\left(\frac{4}{3}\right)^2$ (c) $\left(\frac{7}{-6}\right)^2$ (d) $\left(\frac{3}{-2}\right)^3$

30. (a) 1 (b) 1 (c) 1 (d) 1

(e) 2 (f) 1 (g) 1 (h) 1

31. (a) $\frac{1}{6}$ (b) $\frac{-1}{7}$ (c) $\frac{4}{1}$ (d) $\frac{-2}{1}$

32. (a) $\frac{1}{125}$ (b) $\frac{-1}{32}$ (c) $\frac{256}{1}$ (d) $\frac{27}{64}$

(e) $\frac{625}{16}$ (f) $\frac{-125}{27}$ (g) $\frac{125}{9}$ (h) $\frac{1225}{16}$

33. (a) $(4)^3$ (b) $(-2)^6$ (c) $\left(\frac{1}{5}\right)^9$ (d) $(-4)^{12}$

(e) $\left(\frac{-2}{3}\right)^6$ (f) $\left(\frac{1}{2}\right)^{12}$

34. (a) $\left(\frac{9}{8}\right)^{-7}$ (b) $\left(\frac{-23}{5}\right)^{-8}$ (c) $(-2)^{-11}$ (d) $(4)^{-14}$

(e) $\left(\frac{1}{3}\right)^{-2}$ (f) $(-2)^{-5}$

35. 0

36. p=0, q=0

37. (a) $\left(\frac{2}{3}\right)^5$ (b) $\left(-\frac{4}{7}\right)^1$ (c) $\left(\frac{5}{4}\right)^2$ (d) $\left(-\frac{32}{25}\right)^1$

38. (a) $\frac{25}{36}$ (b) $\frac{1}{10000}$ (c) $\frac{1}{16}$ (d) $-\frac{4}{15}$
(e) -2 (f) $-\frac{4}{13}$

39. $\frac{-5}{7}$ **40.** $\frac{-7}{8}$ **41.** $\frac{1}{3}$ **42.** $\frac{64}{27}$

43. $-2 \times \left(\frac{4}{27}\right)^3$ **44.** -3 **45.** 14 **46.** $\frac{1}{256}$

1.4 Decimal Representation of Rational Numbers

1. (b) **2.** (d) **3.** (b) **4.** (d) **5.** (c)
6. (c) **7.** (c) **8.** (c) **9.** (d) **10.** (b)
11. (b) **12.** (a) terminating, non-terminating repeating
(b) 2 and 5 (c) infinite
(d) $1 \le k \le 10$, an integer (e) terminating
13. (i) T (ii) F (iii) F (iv) T (v) T
14. $\frac{-2}{5}, \frac{15}{20}, \frac{-11}{20}, \frac{-73}{8}$ **15.** $\frac{1}{12}, 3^{-3}$
16. (a) 3.2×10^{-11} (b) 1.234×10^{-9} (c) 6.3×10^{0}
(d) 1.543×10^{13} (e) 9.75×10^{6} (f) 1.30900672×10^{8}
17. (b), (d) and (e)
18. (a) 3700000 (b) .000000069 (c) 1640000000
(d) .000000785 (e) 23800000000000000
(f) .00000000000000000307
19. 0.5, 0.25, 0.75, 0.125, –0.1, –0.4, 0.6, 0.375, –0.7, –0.36
20. $0.\overline{3}$, $0.\overline{6}$, $-0.\overline{4}$, $-0.1\overline{3}$, $0.8\overline{3}$, $-0.\overline{571428}$
21. $\frac{13}{100}, \frac{23}{100}, \frac{157}{50}, \frac{507}{100}, \frac{71}{10}, \frac{999}{100}, \frac{999}{1000}, \frac{999}{10}, \frac{101}{10}, \frac{101}{10}, -\frac{7}{20}, -\frac{26}{5}$
22. $\frac{2}{3}, \frac{13}{99}, \frac{5}{11}, \frac{50}{99}, \frac{133}{100}, \frac{370}{333}$
23. 99 **24.** 90

25. (a) $\frac{116}{3}$ (b) $\frac{10}{3}$ (c) $\frac{10}{9}$ (d) $\frac{74}{45}$

27. 0.6, $0.5\overline{9}$; 1.3, $1.2\overline{9}$; 23.4, $23.3\overline{9}$; 26.2, $26.1\overline{9}$; 3.59, $3.58\overline{9}$

UNIT TWO

Algebra

2.1 Algebraic Expressions

1. (b) **2.** (a) **3.** (c) **4.** (b) **5.** (b)

6. (c) **7.** (a) **8.** (c) **9.** (d) **10.** (b)

11. (a) product (b) product (c) 2ab (d) –2ab
(e) a^2-b^2 (f) 2a–b (g) 7x+5y (h) add the products
(i) binomial with each term of the other binomial
(j) factors (k) common to

12. (a) Commutative property of multiplication
(b) Associative property of multiplication
(c) Distributive property
(d) Commutative property of multiplication
(e) Distributive property
(f) Associative property of multiplication
(g) Commutative property of multiplication

13. (a) F (b) T (c) F (d) F (e) F
(f) F (g) F (h) F (i) F (j) F
(k) T (l) F

14. (a), (v); (b), (i); (c), (ii); (d), (iii); (e), (iv)

15. (a) 5 (b) –5 (c) $\frac{-13}{4}$ (d) $\frac{-91}{16}$

16. (a) 85 (b) –11 (c) $\frac{-313}{64}$ (d) $\frac{159}{32}$

17. (a) $6ab$ (b) $-18a^2b$ (c) $-6a^2bx$ (d) $\frac{1}{8}x^5\ y^2$

18. (a) $18a^2x^3y^2$ (b) $30ax^4y^3$

(c) $\frac{3}{2}p^6q^6r^6$ (d) $\frac{3}{2}a^5b^4c^4$

19. (a) $30x^3y^6$ (b) $-21a^4b^4c^4d^4$ (c) 0

20. (a) $-72a + 63b$ (b) $15r^2t + 21rt^2$

(c) $\frac{1}{4}x^2y^2 + 2x^2y^2z^2$ (d) $a^3bc - ab^3c$

(e) $2a^4b + 2ab^4$ (f) $70x - 70y^2$

21. (a) $2x^2$ (b) 0 (c) $2ab$

(d) $2a^2b + 2b^2c + 2c^2a + ab^2 + bc^2 + ca^2 + 3abc$

23. (a) $9x^2 + 24xy + 16y^2$ (b) $36a^2 + 84a + 49$

(c) $25 + 20y + 4y^2$ (d) $p^4 + 2p^2q^2 + q^4$

24. (a) $4a^2 - 49b^2$ (b) $49 - 64m^2$

(c) $x^6 - y^4$ (d) $p^4 - q^4$

25. x^2+2x+1 (b) $4x^2-12xy+9y^2$ (c) $y^2+\frac{1}{y^2}-2$

26. 9979 (b) 39999 (c) 360 (d) -1040

(e) 488601 (f) 491401 (g) 99980001 (h) 1234321

27. (a) $5(a + 4b)$ (b) $-3(2x - 5y)$ (c) $a(a + 3b)$

(d) $5q(2p-3q^2)$ (e) $-2x(1+2x-4x^2)$ (f) $p^2q^2(5p^2q^2-4pqr^3+3r^2s^2)$

28. (a) $(x + 3)(x + 3)$ (b) $(2x + 3)(2x + 3)$

(c) $(2p + \frac{1}{2}q)(2p + \frac{1}{2}q)$ (d) $(6x^2 + 7)(6x^2 + 7)$

(e) $(p-3)(p-3)$ (f) $(3p - 4)(3p - 4)$

(g) $(4p - 3q)(4p - 3q)$ (h) $(5p^2 - q^2)(5p^2 - q^2)$

(i) $(10s + 4t)(10s - 4t)$ (d) $(25x + 6m)(25x - 6m)$

(k) $(7z + 11)(7z - 11)$ (l) $(100 + x^8)(100 - x^8)$

29. (a) 2 (b) a (c) $2ks$ (d) sh

(e) $3xyz$ (f) $15a^2b$ (g) $7abc$ (h) $9m^2n^2p^2$

(i) $49pqr$

30. (a) $-\frac{9}{4}x^6$ (b) $18x^7$

31. (a) $\frac{25}{4}$ (b) $\frac{-1}{64}$ (c) $\frac{63}{256}$

32. (a) $4x^6 - 20x^3y + 25y^2$ (b) $p^6 - 2p^3q^3 + q^6$ (c) $36a^2 + 12af^2 + f^4$

33. (a) $(p + q)(x + y)$ (b) $(2x + y)(p + q)$
(c) $(3x - y)(p + q)$ (d) $(a^2 + 4)(a + 2)(a - 2)$
(e) $(4c^2 + 9d^2)(2c + 3d)(2c - 3d)$
(f) $(3y + 7z)(3y + 7z)(3y - 7z)(3y - 7z)$

34. (a) $g + h$ (b) $17pq(a + b)$ (c) $x + y$ (d) $(5r + 7s)$
(e) $6 - 5x$ (f) $p^2 - q^2$ (g) $(a + b)(a^2 + b^2)$

35. 313.6 m **36.** 129.6 **37.** 9×10^{10} Joules

38. (a) $(x+1-3a)(x+1-3a)$ (b) $(p - q + r)(p - q - r)$
(c) $(a^{-2} + b^{-2})(a^{-2} - b^{-2})$ (d) $(3 + a^3 - b^3)(3 - a^3 + b^3)$
(e) $(x^8 + y^8)(x^8 - y^8 + 1)$ (f) $(p + q - a + b)(p + q + a - b)$

39. (a) 1 (b) 14y (c) 1 (d) 6x + 7y
(e) 2x + 5y – 4z

2.2 Linear Equations in One Variable

1. (c) **2.** (b) **3.** (c) **4.** (c) **5.** (d)
6. (c) **7.** (b)

8. (a) variable (s) (b) solution, root (c) $\neq 0$
(d) b, c (e) $\frac{6}{5}$

9. (i) F (ii) F (iii) F

10. (a) $\frac{-1}{6}$ (b) $\frac{25}{4}$ (c) $\frac{3}{p}$ (d) $\frac{42}{19}$ (e) $\frac{19}{88}$
(f) $\frac{-57}{11}$ (g) $\frac{77}{19}$ (h) –1 (i) $\frac{45}{29}$ (j) $\frac{25}{2}$
(k) $\frac{41}{10}$ (l) $\frac{-30}{17}$ (m) 0

11. 35 cm, 15 cm **12.** Rs 64 **13.** 15 and 75
14. 7 **15.** 31.5 m **16.** 1867 **17.** Rs 1474

18. 48, total peanuts would have been 40 and in that case, the child could not have given whole number of peanuts to the squirrels.

19. 17 **20.** 28 years **21.** 10 p and 30 p respectively

22. 150 *ml* **24.** No, the step $\frac{(2x+1)+(x-3)}{5+2} = \frac{7}{11}$ is wrong

25. 18 years **26.** 30

UNIT THREE

Commercial Mathematics

3.1 Direct and Inverse Variations

1. (c) **2.** (d) **3.** (a) **4.** (c) **5.** (b)

6. (a) **7.** (a)

8. (a) directly (b) xy (c) $\frac{x}{y}$ (d) inversely (e) uniform

(f) one hour (g) speed, time, distance (h) 10

(i) directly (j) inversely (k) $5\frac{1}{3}$

9. (a) real number k, $\frac{x}{y} = k$ for rational number k, $xy = k$

(b) 'uniform' for 'average'

(c) one hour for h hours

(d) speed = $\frac{\text{distance}}{\text{time}}$

(e) 10m/s for 8 m/s

(f) length of the bridge + length of the train

(g) inversely for directly

(h) directly for inversely

10. (i) T (ii) F (iii) T

11. x and y **12.** (c) and (d)

13. 108 **14.** 122 **15.** 215 km
16. 1.925 cm **17.** Rs 1575 **18.** 539.014 kg
19. $59\frac{8}{9}$ days **20.** 10 km **21.** 3.25 hours
22. 4 km/h **23.** 45 km/h, $7\frac{2}{9}$ hours
24. 2550 m **25.** $4\frac{4}{5}$ hours **26.** 400 m
27. 32 seconds **28.** 27 seconds
29. 423 m **30.** 108 km/h, $13\frac{1}{3}$ seconds
31. $17\frac{1}{7}$ days **32.** 30 km/h
33. 250 m, 16 minutes
34. 4 km, $5\frac{1}{3}$ km/h **35.** 8.48 *a.m.*, 81 km **36.** 750 m

3.2 Percentage and Some Applications

1. (b) **2.** (d) **3.** (b) **4.** (c) **5.** (c)
6. (a) **7.** (a) gain and 100
(b) loss, 100 and100 × S. P.
(c) Marked (d) Time, Rate, Principal (e) Rs 168
8. (i) F (ii) T (iii) F (iv) T (v) F
9. 800 **10.** Rs 700 **11.** 80% **12.** 85%
13. Rs 220 **14.** Rs 437.50 **15.** Rs 500 **16.** $1\frac{1}{3}$ years
17. (a) 500 (b) 150 (c) 960 (d) 100
18. Rs 12000 **19.** Rs 850
20. (a) Rs 633.75 (b) Rs 1280.50 (c) Rs 5177.50
21. (a) Rs 3500 (b) Rs 500 (c) Rs 10000
22. (a) 10% (b) $26\frac{1}{4}\%$ (c) 3%
23. (a) Rs 192, Rs 992 (b) Rs 162, Rs 612 (c) Rs 240, Rs 840

24. (a) Rs 400 (b) Rs 350 (c) Rs 800

25. (a) $2\frac{1}{2}$ years (b) six months (c) 7 years

26. (a) $7\frac{1}{2}$ % (b) 13 % (c) 18 % **27.** 10%

28. Rs 633.75 **29.** Rs 160 **30** Rs 1371.20

31. Rs 380 **32.** Rs 220 **33.** Rs 1250

34. Rs 163.40 **35.** Rs 0.8625 per pen **36.** Rs 85 gain

37. Rs 24 **38.** Rs 3 loss **39.** 1 : 2

40. Rs 500 **41.** 10% **42.** Rs 264

43. 25 **44.** Rs $1142\frac{6}{7}$ **45.** gain, $33\frac{1}{3}$%

46. 25%, 5% loss **47.** Rs $208\frac{13}{14}$ **48.** Rs 72

49. Rs 40 **50.** Rs 7915.875 **51.** Rs 1000

52. Rs $13\frac{1}{3}$ **53.** Rs 3000 at 9% or Rs 1350 at 10%

54. Rs 500, 10% **55.** Rs 525 **56.** Rs 500000

57. 1 2 kg, 23 kg **58.** 4700 **59.** Rs 4468.80

UNIT FOUR

Geometry

4.1 Triangle

1. (c) **2.** (b) **3.** (c) **4.** (a) **5.** (d)

6. (a) **7.** (a) three (b) at least two

(c) one (d) three (e) no

8 (a) sum of these two angles > 180°

(b) sum of the three angles is < 180°

(c) $4 + 2 < 7$

(d) other interior angle will be 0°

(e) these perpendiculars will be parallel to each other

9. (i) T (ii) F (iii) T (iv) F (v) F
(vi) T (vii) F (viii) F (ix) F (x) F

10. 45° **11.** 50° each **12.** 45° each **13.** 70°

14. $55^\circ, 40^\circ, 85^\circ$ **15.** It is more than 90°, obtuse triangle

16. 360° **17.** 40°

18. For ΔADC, $\angle A = 50^\circ$, $\angle D = 100^\circ$, $\angle C = 30^\circ$ and for ΔBDC, $\angle B = 70^\circ$, $\angle D = 80^\circ$, $\angle C = 30^\circ$

19. Because $3.2 + 3.2 < 6.8$

20. No, because sum of interior angles A and B = $183^\circ > 180^\circ$

21. $48^\circ, 60^\circ, 72^\circ$

22. 50° **23.** $a + b > c$, $b + c > a$, $c + a > b$

24. (i) 40° (ii) 110° **25.** 135° **26.** (i) 40° (ii) 40° (iii) 50°

27. 90° **28.** 90° **29.** 10°

30. (i) sum is 180°

(ii) Yes, because interior angles on the same side of the transversal are supplementary

31. $90^\circ - \frac{x^\circ}{2}$ **32.** 25° **33.** $72\frac{1^\circ}{2}$

34. (a) $AB - AL < BL$; $AC - AL < CL$ etc.

(b) $AB + BL > AL$, $AC + CL > AL$, etc.

35. 150° **36.** (i) 45° (ii) 55°

4.2 Circle

1. (c) **2.** (b) **3.** (d) **4.** (c) **5.** (a)

6. (a) equidistant (b) radius (c) radius (d) equal
(e) same centre (f) on the circle (g) passes through the centre
(h) equal (i) chord (j) its radius (k) circular region
(l) two (m) is not (n) its diameter or centre

7. (i) T (ii) F (iii) F (iv) T (v) T

14. (i) chord (ii) chord (iii) radius (iv) diameter
(v) chord (vi) radius
18. 5 cm **19.** No **20.** Yes **21.** Segment of a circle

4.3 Geometrical Constructions

1. (b) **2.** (a)
3. (a) M lies on AB and AM = BM
(b) It passes through its mid-point
(c) $\angle$ BAX = $\angle$ CAX
(d) are at right angles
(e) its mid-point, perpendicular to
(f) they have the same measure
(g) hypotenuse
4. (i) F (ii) F (iii) T (iv) F
(v) T (vi) T
25. Yes **28.** Yes
29. Yes **30.** parallelogram

4.4 More About Triangles

1. (a) **2.** (b) **3.** (b) **4.** (b) **5.** (b)
6. (d) **7.** (b) **8.** (c) **9.** (b) **10.** (c)
11. (a) **12.** (a) equal (b) $a^2 + b^2$ (c) equal
(d) angle opposite to side b is
(e) $13^2 = 12^2 + 5^2$ (f) hypotenuse (g) perpendicular to it
(h) orthocentre (i) equilateral (j) centroid
13. (a) AC (b) $\angle$BAC (c) AB (d) hypotenuse
(e) vertex of the right angle
14. (i) T (ii) T (iii) F (iv) T
(v) F (vi) T (vii) T
15. 40° **16.** 15°

17. (i) T (ii) T (iii) T (iv) T
18. Yes, 7.5 cm **19.** Yes **20.** 12 cm
21. 45°, 2 cm **23.** 2.0 cm **25.** Yes
26. 30°, Yes **27.** 90°, No
28. 125°, 40° and 15°
30. (i) Joining P with the vertices and checking if AP and BP are bisectors of $\angle A$ and $\angle B$ respectively.
(ii) Joining AP and BP and producing it to meet BC and CA and then checking whether BC and CA are bisected by them.
(iii) Joining PA, PB and PC and checking if PA = PB = PC.

4.5 Congruent Figures

1. (c) **2.** (b) **3.** (c) **4.** (a) **5.** (a)
6. (a) the included angle between them, corresponding
(b) included side between them, corresponding
(c) three, corresponding parts of the other triangle
(d) hypotenuse, corresponding parts of the other triangle
(e) (i) FD (ii) DE (iii) FE
(iv) $\angle F$ (v) $\angle D$ (vi) $\angle E$
7. (i) T (ii) T (iii) T (iv) T
(v) T (vi) F (vii) T (viii) T
8. (a) SAS (b) none (c) ASA (d) none
9. (i) PR (ii) $\angle P$
10. (a) Yes, ASA (b) Yes, none (c) Yes, SSS (d) Yes, RHS
11. OA = OB, OC = OD, $\angle AOC = \angle BOD$; Yes; $\Delta AOC \cong \Delta BOD$; SAS
12. Yes, $\Delta ABD \cong \Delta ACD$, RHS, CD, $\angle C$
13. Yes, $\Delta ABC \cong \Delta DBC$, SSS, Yes
14. $\Delta ABC \cong \Delta CDA$ **15.** Yes, SSS, 50°
16. Yes, SAS, 130° **17.** $\Delta ABD \cong \Delta ACD$, 115° **20.** Yes
21. Yes; (i) ΔBCF and ΔCBE; BC = CB, $\angle ABC = \angle ACB$, $\angle FCB = \angle EBC$
22. Yes **23.** TS **24.** By showing $\Delta EAF \cong \Delta DAF$
26. Yes, $\Delta PAM \cong \Delta QAM$, etc.

4.6 Quadrilateral

1. (d) **2.** (b) **3.** (a) **4.** (c) **5.** (c)
6. (c) **7.** (d) **8.** (c) **9.** (c) **10.** (d)
11. (a) 360° (b) equal (c) equal (d) bisect each other
(e) one angle is right angle (f) adjacent sides are equal
(g) one angle is right angle (h) adjacent sides are equal
(i) a pair of opposite sides are parallel
12. (i) T (ii) F (iii) T (iv) F (v) F
13. (a) S (b) A (c) A (d) S
14. 123 **15.** 84° **16.** 135°, 135°, yes **17.** 72°, 108°, 72°, 108°
18. Yes, trapezium **19.** 90° each, yes, rectangle
20. 56° **22.** Yes **23.** Yes **24.** 90° **27.** 55°
28. 60°,120°, 60°, 120° **29.** 60°, 120°, 60°, 120°
30. Yes, yes, yes, parallelogram
31. 1.5 cm **32.** parallelogram **33.** 2 : 3
34. 2.5 cm, No, Not of any special type **35.** Yes
36. 4 cm **37.** 18°, 54°, 126°, 162°; trapezium
38. 18° **39.** Yes
42. (a) Yes (b) Yes (c) Yes (d) Yes **44.** Yes

UNIT FIVE

Mensuration

5.1 Areas

1. (c) **2.** (b) **3.** (d) **4.** (b) **5.** (d)
6. (a) **7.** (b) **8.** (c) **9.** (a) **10.** (a)
11. (d) **12.** (b) **13.** (c) **14.** (a) **15.** (d)
16. (d) **17.** (b) **18.** (d) **19.** (c) **20.** (b)
21. (d) **22.** (d) **23.** (d) **24.** (a)

25. (a) its interior (b) of side 1 m (c) 10000
(a) length, breadth (e) square (f) length, breadth, height
(g) 4 × its side (h) triangle (i) double (j) 9
(k) 2.8 (l) 165 (m) 90
(n) $\frac{40}{49}$ times (o) smallest (p) square

26. (a) 234 (b) 200 m (c) 150 (d) 240 m
(e) 320 (f) 40

27. (i) F (ii) F (iii) T (iv) F
(v) T (vi) F (vii) F (viii) T
(ix) T (x) F (xi) F (xii) F

28. (i), (c); (ii), (d); (iii), (a); (iv), (f); (v), (h); (vi), (b); (vii), (e); (viii), (g)

29. (i) 4.29 cm^2 (ii) 51.3 cm^2 (iii) 7.02 cm^2
(iv) 11500 cm^2 (v) 2280 cm^2

30. (i) 2.89 m^2 (ii) .0841 m^2 (iii) 24025 m^2
(iv) 608400 m^2 (v) $1\frac{81}{1600}$ m^2

31. 6.4 cm, 2.47 cm^2; 15 cm, 60 cm; 1184 cm, 18944 cm^2

32. These areas are equal

33. (i) No change (ii) No change (iii) Area will be $\frac{1}{4}$th

34. 600 cm^2 **35.** 20 m

36. (i) 2850 m^2 (ii) 0.621 m^2 (iii) 4187 m^2
(iv) 11050m^2 (v) 0.4128 m^2

37. 16 cm, 12 cm^2; 8 cm, 48 cm^2; 18 cm; 48cm^2; 12 cm, 192 cm^2

38. (a) 54 cm^2 (b) 96 cm^2 **39.** 729600 cm^2 **40.** 2.64 *ha*

41. 200 m **42.** Rs 48061.50 **43** Rs 1209.98 (approx)

44. 24.10 *ares* **45.** $22\frac{2}{9}$ minutes

46. 320 cm **47.** 74 cm **48.** 125 cm **49.** 30 m

50. 396 m **51.** 36 *ares* **52.** Rs 75 per metre

53. Rakesh, 1 *are* **54.** Rs 192 **55.** 880 m

56. 4.5 m^2 **57.** 15 cm, 1995 **58.** 230.4 m^2
59. 2604 m^2 **60.** Rs 1.50 per square metre **61.** 441 m^2
62. Rs 14244 **63.** 24 : 25 **64.** (a) 308 m^2 (b) 2700 m^2
65. (a) 75.25 cm^2 (b) Rs 93.15 **66.** Rs 1820 **67.** 76 cm^2 **68.** 1125 m^2
69. 160 cm^2 **70.** 7550 cm^2 **71.** 3600 cm^2
72 3200 cm^2, it is half of the area of the original square
73. 625 sq. units
74. 125 sq. units **75.** 900 sq. units **76.** 75 cm^2
77. 48 sq. units **78.** 126 sq. units **79.** 80 sq. units

5.2 Volumes and Surface Areas

1. (b) **2.** (d) **3.** (c) **4.** (d) **5.** (c)
6. (c) **7.** (d) **8.** (c) **9.** (a) **10.** (a)
11. (d) **12.** (b) **13.** (d) **14.** (d) **15.** (d)
16. (a) eight (b) twelve (c) six (d) adjacent faces
(e) three (f) edges (g) cube (h) four (i) 10^6
(j) 1 (k) 1 (l) 512 cm^3 (m) 1 (n) 50
17. (i) F (ii) F (iii) F (iv) F (v) F
(vi) T (vii) F (viii) T (ix) T (x) T
(xi) F (xii) F (xiii) T (xiv) T
18. (a), (vi); (b), (v); (c), (ii); (d), (viii); (e), (iv); (f), (vii); (g), (iii); (h), (i)
19. (a) P, Q, R, S, U, V, W, X
(b) PU, SX, QV, RW, PQ, QR, RS, SP, UV, VW, WX, XU
(c) PQRS, UVWX, UXSP, QVWR, SXWR, UVQP
(d) UVWX
(e) UXSP, QVWR, SXWR, UVQP
(f) PQRS and UVWX, two
(g) UVWX, PUXS, SXWR; UVWX and QVWR
(h) UP, PQ and PS; PQRS, PUXS and PUVQ
20. (a) BC, FG, EH; DC, EF, HG, (b) ABCD, EFGH (c) ABCD and EFGH, 20 cm^2 (d) ADHE and BCGF (e) 60 cm^3 (f) 94 cm^2 (g) 20 cm^2 (h) No
21. (a) 126 cm^3 (b) 100 dm^3 (c) 120 dm^3 (d) 10 cm^3 (e) 27 m^3

22. (a) 162 cm^2 (b) 240 dm^2 (c) 678 dm^2 (d) 34 cm^2 (e) 54 m^2
23. 480 m^3 **24.** 100 cm^3, 130 cm^2
25. (a) 0.003375 m^3, 0.135 m^2 (b) 0.343 m^3, 2.94 m^2 (c) 15.625 m^3, 37.5m^2
26. 4 cm **27.** 6 m **28.** 30 m^3 **29.** 84 **30.** 96 m^3
31. 4 cm × 4 cm × 1 cm **32.** 576 **33.** 2550 **34.** 27 : 1
35. 2 m **36.** 0.001 m **37.** 150 **38.** 100 **39.** 20 cm
40. 237 m^2 **41.** Rs 2880 **42.** 90 **43.** 3 days
44. 30.25 m **45.** 5 m **46.** 16 cm **47.** 1200 **48.** 27000
49. Rs 324 **50.** 48 m

UNIT SIX

Statistics

6.1 Bar Graphs

1. (ii) third, sixth (iii) (c)
2. (ii) 1984 (iii) (c)
3. No **4.** (i) (d) (ii) (a) (iii) (a)
5. (ii) 1985 **6.** (i) (b) (ii) (a) (iii) (b)
7. 1986-87 **8.** (ii) (c) **9.** (ii) (c) **10.** DCE

UNIT TESTS

Arithmetic

1. (b) **2.** (a) **3.** (i) −3, −2 (ii) $\left(\frac{-3}{2}\right)^4$
4. (i) F (ii) F **5.** $\frac{-9}{4}$ **6.** $\frac{-43}{72}, \frac{-97}{144}$ **7.** $\frac{-5}{2}$ **8.** $\frac{-39}{10}$

9. All numbers lying between $\frac{-2}{5}$ and $\frac{2}{5}$

10. 1 **11.** $\left(\frac{-3}{2}\right)^6$ **12.** 1.35×10^{-8} **13.** $11.7, 11.6\overline{9}$ **14.** $\frac{-220}{-550}$

15. $\frac{7}{-8}, \frac{5}{-6}, \frac{-4}{5}, \frac{-3}{4}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}$ **16.** $\frac{71}{30}$

17. 3^0 **18.** $\frac{2^7}{7^6}$ **19.** $\frac{499}{50}$ **20.** $\frac{134}{99}$

Algebra

1. (c) **2.** (d) **3.** (i) 2ab (ii) product, variable
4. (i) F (ii) T **5.** −141 **6.** −15 abxy
7. $24x^4 y^3 z^2$ **8.** $2x^2$ **9.** $9x^2 + 42xy + 49y^2$

10. 9856 **11.** .641601 **12.** 5y (3x−2y) **13.** $x = \frac{25}{2}$

14. 8 **15.** $(2x + \frac{1}{2}y)$ $(2x + \frac{1}{2}y)$

16. $(9x^2 + 4)(3x + 2)(3x - 2)$ **17.** a + b
18. $(x^2 + y^2)(x + y)(x - y)(x^4 - y^4 + 1)$
19. $11x + 5 = 0$
20. 35 cm, 15 cm

Commercial Mathematics and Statistics

1. (c) **2.** (a) **3.** (i) directly (ii) loss, 100
4. (i) F (ii) T **5.** Rs 1680 **6.** $187\frac{1}{2}$ days
7. 5.2 km/hr **8.** 800 **9.** 26.25% **10.** Rs 250
11. 10% **12.** 423 m **13.** 24 days **14.** 5580

15. Rs 0.86 (approx) **16.** Rs 4033.26

17. Rs 350 **18.** 25% gain **19.** Rs $325\frac{5}{7}$ **20.** Yes

Geometry

1. (d) **2.** (b) **3.** (i) longest (ii) incentre

4. (i) F (ii) F **5.** $40^\circ, 60^\circ, 80^\circ$

6. $\overset{\frown}{AP}$, PD, $\overset{\frown}{BD}$, $\overset{\frown}{PB}$, $\overset{\frown}{CP}$, $\overset{\frown}{AC}$, $\overset{\frown}{CQ}$, $\overset{\frown}{BQ}$, $\overset{\frown}{BC}$, $\overset{\frown}{QA}$, $\overset{\frown}{QD}$, $\overset{\frown}{QP}$; O

7. 110° (i) Yes (ii) Yes

12. $80^\circ, 100^\circ$ $80^\circ, 100^\circ$ **13.** 70° **14.** $50^\circ, 30^\circ$

15. 6 cm **16.** 60° **17.** 4 cm, $\frac{8}{3}$ cm **18.** Yes

19 (i) Yes (ii) Yes **20.** $20^\circ, 40^\circ, 140^\circ, 160^\circ$; trapezium

Mensuration

1. (b) **2.** (c) **3.** (i) 100 (ii) Three

4. (i) F (ii) T **5.** 15 cm^2 **6.** No change **7.** 7 m **8.** 30 m

9. 200000 cm^3 **10.** 726 m^2 **11.** 3 cm

12. 8000 cm^3 **13.** 5256.25 m^2

14 1960 m^2 **15.** 2523 m^2 **16.** 36 cm^2

17. 8000000 *l* **18.** 4 cm × 4 cm × 1 cm

19. 880 **20.** 7.5 m

Some Interesting Problems

1. No; it is yes for a = 1 and b = –1 as also for a = –1 and b = 1

2. (a) straight angle

(b) right angle

(c) triangle, trichotomy law
(d) Quadrilateral
(e) Faces of a cuboid, hexagon
(f) edges of a cuboid
(g) Pythagorean triplets
(h) Pythagorean triplets
(i) 36 km/h = 10 m/s
(j) litres, *ml*, km, m; kg, g, etc.

3. (a) $99\frac{9}{9}$ (b) $6\times5\times3+9\times8+4\times2-7\times10$

4. (a) 4 (b) 2 **5.** 5°

6. 5 girls **7.** 21

8. 1089 **9.** 12 : 5

10. 100 t + 10 u + 1 **11.** 4

12. 180 **13.** $\frac{1}{7}$

14. 28% **15.** 24 cm^3

16. $34\frac{2}{7}$ km/h **17.** $39\frac{1}{16}\%$

18. Rs 10 loss **19.** (i), (iii) and (v)

20. $16\frac{2}{3}\%$ **21.** Rs 65.70 per kg; Rs 73 per kg

22. 1 : 4

23. $\frac{(a+b)^2}{2}$ cm^2 **24.** Acute

25. $\frac{bh}{b+2h}$ **26.** Yes, $3\frac{9}{17}$ hours

27. Yes, diameter, $\sqrt{2}$ cm **28.** 150

29. $4\frac{4}{5}\%$ **30.** 312.5 m

31. 1 : 1 **32.** 1 : 4

33. 7 ; No **34.** two

35. seven **36.** 125%

37. (iii)

38. parallelogram

39. (a) 8 (b) 36 (c) 54 (d) 27

40. 24 (a) 8 (b) 12 (c) 4 (d) 0

41. (a) 216 (b) 8 (c) 24 (d) 24 (e) 24 (f) 72 (g) 72 (h) 0

42. 50 m^2

43. 52